NAVAL POSTGRADUATE SCHOOL
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THESIS

REPORT OF TESTS OF A COMPRESSOR CONFIGURATION
OF CD BLADING

by

Yuksel Koyuncu

March 1984

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20. Abstract (continued)

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Report of Tests of a Compressor Configuration of CD Blading

by

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ABSTRACT

Results of 14 tests in a subsonic cascade are reported in which the air inlet angle and Reynolds number were varied. The cascade contained 20 Controlled Diffusion (CD) blades, with 5.01 inches chord, aspect ratio of 2.0 and solidity of 1.67. Pneumatic probe surveys and surface pressure measurements were used to obtain blade performance and flow quality data. There was no measurable influence of the Reynolds number on the blade losses in the range of Re. = 474000 to Re. = 690000. Fourteen tests, using seven different inlet air angles over a range of 24 to 46 degrees generated generally well behaved blade performance parameters. The results were compared with previous results from a corresponding cascade of DCA blades.

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I. INTRODUCTION

A numerical optimization technique to design CD blading was developed by NASA [Ref. 1] and used to replace Double-Circular-Arc compressor blading in the stator of an axial transonic compressor. The purpose of the present study was to measure the on and off-design blade element performance of the CD blading section designed for the stator mid-span, and to compare the results with results obtained earlier for the DCA section which it replaced.

Preliminary measurements with the DCA blading were reported by Cina [Ref. 2] and Molloy [Ref. 3]. Cina showed that a modification to the Inlet Guide Vane (IGV) assembly was necessary to achieve periodic flow from one three inch test-blade passage to the next. The IGV assembly was modified such that the vanes were placed at one inch rather than two inch intervals. Molloy encountered IGV blade flutter after the modification. To overcome IGV flutter, plenum chamber turning vanes were installed to reduce turbulent excitation and the vane actuating mechanism was stiffened. With much improved flow quality, Himes subsequently obtained and reported performance data for the (reference) DCA blade section.

The present report documents an experimental program of 14 tests carried out using the CD blading. A description of the test facility and instrumentation is given in section II. In section III cascade concepts are discussed and the experimental procedures which were followed in obtaining data are explained. The cascade configuration and test parameters are given in section IV. Results are presented in the form of figures and tables and where necessary, as separate appendices. The flow quality documentation is given in Appendix A. Appendix B contains a description of data storage.

II. TEST FACILITY

A. HIGH REYNOLDS NUMBER CASCADE

The cascade and power supply system are shown in Figure 1. A detailed description is given in Reference [5]. Figure 2 shows a view of the cascade.

The cascade test section instrumentation placement is given in Figure 3 with physical dimensions The test facility was the same as that used by Himes [Ref. 4]. Plenum modifications were reported in Reference [6].

B. INSTRUMENTATION

1. Survey Probes

Measurements were taken in the spanwise and blade-to-blade directions using two five hole probes at the 'upper' and 'lower' planes. (Figure 3)

A DC-125-24-F-22-CD probe, serial number A971-2 was used for upper plane surveys. A DA-125 probe, serial number A847-1 was used for lower plane surveys.

2. Reference Probes

Three probes were used for reference static and total pressure measurements.

Plenum chamber reference total pressure was measured using a pressure tube placed in the plenum. Reference static pressure was measured using a wall static port at the lower

plane of the cascade. A pitot-static probe (aligned with the inlet flow) ahead of the test blading was used to give redundancy in reference measurements.

3. Wall Pressure Taps

Twenty pressure taps were located in the blade-to-blade direction two inches apart at the lower and upper planes of the cascade south wall. To visualize the static pressure distributions at the lower and upper planes each set of taps was connected to a water-column manometer bank.

4. Acquisition and Reduction System

Data were acquired using a Hewlett Packard HP-3052 Data Acquisition System. The HP-9845A desktop computer was used as the system controller for data acquisition and for data reduction and plotting. The necessary programs are documented in Reference [7].

Two 48-port Scanivalves connected to the acquisition system via a NPS/TPL HG-78K Scanivalve Controller and a HP-98034 HP-IB Interface Bus allowed all probe and reference pressures to use a single transducer. Blade surface pressures were sensed by the second Scanivalve transducer.

A schematic of the acquisition system is shown in Figure 5.

5. Measurement Uncertainty

Measurement uncertainties are listed in Table I.

III. EXPERIMENTAL PROCEDURES

A. GENERAL

1. Flow Quality

Flow uniformity, periodicity, and pseudo two-dimensionality are discussed extensively in References [8,9, 10].

Uniformity is a common requirement for all wind tunnels and describes the degree of constancy of measured values in the blade-to-blade and spanwise directions at the inlet plane and in the spanwise direction at the outlet plane.

Periodicity is considered to imply identical conditions in one blade passage to the next at the outlet plane.

Two dimensional flow conditions must also be satisfied in the test section. This implies that the flow in the central test plane be independent of the spanwise displacement. Blade force vectors were calculated using probe survey data in the blade-to-blade direction with the application of the principle of conservation of momentum. Blade force vectors were also computed by integrating surface pressure distributions. The degree of agreement in the two calculations would be expected to be also a measure of the degree of two-dimensionality.

2. Flow Geometry

Figure 6 illustrates the definition of each geometrical parameter used in the calculations. For angular measurements a positive angle is defined as an angle from a vertical reference line in the clockwise direction.

3. Reference Quantities

To remove time dependency of inlet dynamic pressure caused by atmospheric fluctuations and variations in blower speed, each pressure measurement was referenced to plenum conditions, a procedure validated earlier by Duval [Ref. 10].

4. Performance Parameters

Table II shows the formulas which were used for calculation of the performance parameters.

B. SPECIFIC TEST PROCEDURES

1. Probe Calibration

The calibration constants were obtained using Zebner's analytical surface approximation method [Ref. 11] and a computer program developed by Neuhoff [Ref. 12].

2. Test Section Setup and Adjustment

Variations in inlet air angle were obtained by fixing the blade chord angle and varying wall angle and IGV setting. A check of the inlet air angle was made with the lower probe placed at midspan in the center of the blade-to-blade position.

To avoid potential IGV flutter, following Reference [4] the IGV's were moved only when the blower was turned off.

3. Test Measurements

a. Blade-to-Blade Survey

Blade-to-blade surveys were conducted using the upper and lower plane probes simultaneously. Both probes were located at midspan and were traversed in the blade-to-blade direction with the lower probe trailing the upper by 1.5 inches. Measurements were recorded over four adjacent blade spaces, namely, the blade spaces to the left and to the right of the instrumented blade. Survey points were spaced 0.25 inches apart over the outermost spaces and 0.1 inch over the two innermost spaces. The close spacing (0.1 inch) was used in order to define one blade wake as precisely as possible.

b. Spanwise Survey

Spanwise data were taken at the lower and upper planes separately. First, the lower probe was placed at least one blade passage away from the upper probe location. The upper probe was placed one inch from the suction side of the center blade and a spanwise survey was carried out using 0.5 inch increments.

After completing the upper probe survey, the lower probe was placed one inch from the pressure side and a similar spanwise traverse was carried out.

c. Instrumented Blade Pressure Distribution

Blade pressure distribution data were recorded from the instrumented blade after completing blade-to-blade and spanwise probe surveys.

IV. TEST CASCADE AND PARAMETERS

A. BLADING

For the tests reported herein, twenty controlled diffusion (CD) blades were used.

Design data for the test blading, which were constant for the tests, are presented in Table III. The terminology and notation used here generally follows Reference [8].

The three blades which were placed in the center of the test section were instrumented with static pressure taps in order to obtain and verify the blade pressure distribution. The static pressure taps were located at the midspan of each blade. The center blade contained 39 and two adjacent blades each contained six pressure taps.

The center instrumented blade pressure tap locations are shown in Figure 6.

B. TEST PARAMETERS

1. Inlet Air Angle

The inlet air angle ranged from 24 to 46 degrees. Definition of reference minimum-loss incidence angle and selection of the incidence angle range with respect to the reference incidence angle are discussed extensively in Reference [8].

2. Reynolds Number

To examine the possible effect of Reynolds number on the performance of the test cascade each inlet air angle was tested at two different Reynolds numbers.

The Reynolds number and inlet air angle for each test are listed in Table VI.

V. RESULTS

Blade-to-blade probe traverse, spanwise probe traverse and blade surface pressure data were reduced and the results are presented in the form of figures and tables. The results are grouped in order to separate the uniformity and periodicity verification from the results for the blade-element performance parameters.

A. FLOW QUALITY

Uniformity and periodicity results are presented in Appendix A and are summarized in Tables V, VI and VII.

B. CASCADE PERFORMANCE

Cascade performance parameters evaluated from measurements are plotted in Figure 7 through Figure 14 and are listed in Table VII.

VI. DISCUSSION

A. FLOW QUALITY

1. Uniformity

The departure from uniformity of the dynamic pressure, static pressure, total pressure, non-dimensional velocity, inlet and outlet angle are summarized in Tables V, VI and VII.

The blade performance parameters were obtained from blade-to-blade traverse data with the survey probes at the midspan section of the cascade. Tables V, VI and VII show the maximum and minimum deviations of the calculated values of specific parameters over the center twenty percent of the blade span, near midspan, and in the blade-to-blade direction. In the upper and lower planes, flow angle, non-dimensional velocity and dynamic pressure were acceptably uniform in the spanwise and blade-to-blade directions. In the lower plane due to small absolute values* on which they were based, static and total pressure deviations were indicated to be up to 26 percent, however the pressures themselves were considered to be acceptably uniform.

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*Uncertainty for pressure measurements was +0.01 in. H_2O. Magnitude of the uncertainty corresponded closely to the values of the deviations computed.

2. Periodicity

To examine further the periodicity in the blade-to-blade direction, the performance parameters were evaluated using data obtained in a single test** from the four different blade passages. Results are plotted in Figures 15 through 18 and are listed in Tables IX through XIV. Each point in the figures represents a calculated performance parameter for the integration limits indicated by bars in the blade-to-blade direction. Differences are seen in the values obtained over different integration limits. Two factors are considered to contribute to the indicated differences.

First, in the blade-to-blade direction only the center instrumented blade wake was well defined as a result of using small increments (0.1 inches) in displacement in the probe survey procedure. Due to the memory limitation of the HP-9845A desktop computer the three other blade wakes were defined with only 0.25 inches increments. Thus, these blade wakes are considered to be inadequately defined for integration purposes. It is noted that the overlapping parabola technique used for integration can give significant errors where rapid changes occur in the slope or curvature

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**BETA=38.91,Re = 676000

when data are too widely spaced. This part of the difference is an error in data evaluation.

Second, there are small but measureable differences in total pressure levels outside the wake regions which have their origin in differences in flow profiles generated by different passages through the IGV assembly. This can be seen in Figure A91, which shows the total pressure distributions for the particular test conditions represented in Figures 15 through 18. It is noted however that if the distribution in Figure A91 is overlayed with the distribution measured at corresponding blade-to-blade locations at the lower plane (Fig. A96) there is seen to be little difference except in the wave of the test blades.

Thus the differences in Figures 15 through 18 are considered to represent maxima in the possible uncertainties of the quantities plotted. An experiment in which equally detailed surveys are made across multiple passages is required in order to examine the uncertainty in more detail.

3. Pseudo Two Dimensionality

No attempt has been made in the present work to resolve differences found earlier between values of the blade force evaluated from probe measurements, and those from surface pressures. Himes [Ref. 4] reported that the value of Cfm (the blade force coefficient derived from probe survey data) was highly sensitive to small inaccuracies in

the survey data and too coarse a spacing of data points. The present results show improved consistency in the measurements of Cfm but the disagreement remains.

The values of Cfm and CfB, the blade force coefficient derived from instrumented blade pressure distribution data are given in Table VI.

B. CD CASCADE PERFORMANCE

The CD blading test results in Figures 7 and 8 show that there was no measurable effect of the Reynolds number on the blade loss coefficients in the range of Re. = 474000 to Re. = 690000. A minimum loss coefficnet of 0.024 was obtained at an air inlet angle of 34°. Based on twice the minimum loss coefficient, the range of air incidence angle was from 24.3° to 47.2°.

The slope of the static pressure rise coefficient vs inlet air angle shown in Figure 9 was found to change significantly at air inlet angles close to the minimum loss value. A consistent but small effect of the Reynolds number was clearly present. A similar change in slope was observed in the values of the AVDR shown plotted in Figures 12 through 14. It is somewhat curious that the AVDR did not depend more simply on the static pressure rise than the behaviors shown in Figure 12. The largest value of the AVDR was measured at inlet air angles 2° less than the angle for minimum loss.

One further observation concerning air angles less than "reference incidence" should be made. At each of the three such angles tested, a nearly pure tone whistle was produced when the cascade was first turned on at low speeds. The tone was quite loud but could be made to disappear by increasing the blower speed, and therefore the flow velocity. The origin of the tone was not found. It is noted however that no such effect was observed in the tests of the DCA reference blading, and consequently the tone must be associated with the flow through the test blading rather than the IGV assembly.

It is suggested that the IGV assembly did not work well for inlet air angles smaller than 28 degrees. In the figures showing the total pressure distributions at the lower plane***, the IGV wakes for air angles less than 28 degrees are seen to be much greater than for angles which are between 28 degrees and 40 degrees.

C. COMPARISON WITH DCA CASCADE RESULTS

In Figures 7 through 14 Himes results for the reference DCA blading are shown for comparison with the CD blading data using broken lines; some differences are apparent.

***Appendix A, Pt Vs Blade-to-Blade Position.

Himes used the same facility, instrumentation, acquisition and reduction software. The only notable difference was that the lower probe was cleaned and recalibrated for the CD blading tests when suspiciously large pitch angles were indicated by the probe. It was discovered (prior to the tests reported here) that the fluid used to obtain china-clay surface flow visualization [Ref. 6] could, when sprayed on the model, easily contaminate the probe pneumatic ports. Considerable care was taken thereafter to ensure that this did not happen. Contamination may have been the cause of the indicated pitch angles which were not found after probe cleaning and recalibration.

The repeatability of the test data was somewhat improved in the present tests over that achieved by Himes. Constant attention to detail and careful resolution of the blade wakes are thought to be important if the loss data are to be obtained repeatably.

At corresponding inlet air angles, the loss coefficient for the CD blading was determined to be generally less than that for the DCA reference blading (Figure 7) and the variation with inlet air angle was without inflexion points. The static pressure rise coefficient variation however did exhibit an inflexion where the DCA cascade results did not (Figure 10). Static pressure rise was greater at larger inlet air angles (>36°) and less at smaller inlet air angles

(<36°). Differences in the AVDR shown in Figures 12 through 14 would of course effect the cascade pressure rise.

A clear difference was measured in the outlet air angles, 3° greater than those produced by the reference DCA blading at inlet air angles corresponding to large negative incidence. The difference was less than 1° at design inlet air angle and at more positive incidence.

The differences in the behavior of the two blade sets at negative incidence are significant. Careful examination of surface flow conditions may result in better understanding.

VII. CONCLUSIONS

1. The inlet flow was acceptably uniform at the lower plane at air inlet angles greater than about 28°.
2. The flow was acceptably uniform over the center 20 percent of the blade in the spanwise direction at the upper plane.
3. The periodicity at the upper plane is thought to be acceptable; however, equally detailed surveys are required over multiple passages in order to quantify non-periodic effects on the measurements.
4. Loss coefficients were determined to be less than those for the reference DCA blading except at the highest inlet air angles. No Reynolds number dependence was detected over the range of the tests.
5. Outlet air angles ranged from 1/2° to 3° larger than for the DCA blading at corresponding inlet air angles.
6. Static pressure rise coefficient was lower than that for the reference DCA blading at inlet air angles less than 36° and higher at inlet air angles greater than 36°. A small but measurable effect of Reynolds number was detected. Differences in AVDR were present.
7. The test cascade produced an audible whistle at lower speeds and inlet air angles less than reference 'incidence' conditions.

VIII. RECOMMENDATIONS

The following are added to the recommendations given in Reference 4:

1. Consideration should be given to changing the probe survey procedure. Since the flow yaw angle variation is very small at both measurement planes (at least two chord lengths upstream and 1 1/2 chord lengths downstream of the blading), a procedure of surveying at a fixed, average probe yaw angle could possibly be used. Such a procedure would allow more detailed surveys over multiple passages with possibly a reduction in survey time. Proof of the procedure and modifications in software would be required.
2. More information should be sought through the use of flow visualization techniques other than china-clay. This is necessary in order to explain the qualitative changes evident in the performance measurements and to explain the observed audible whistle.

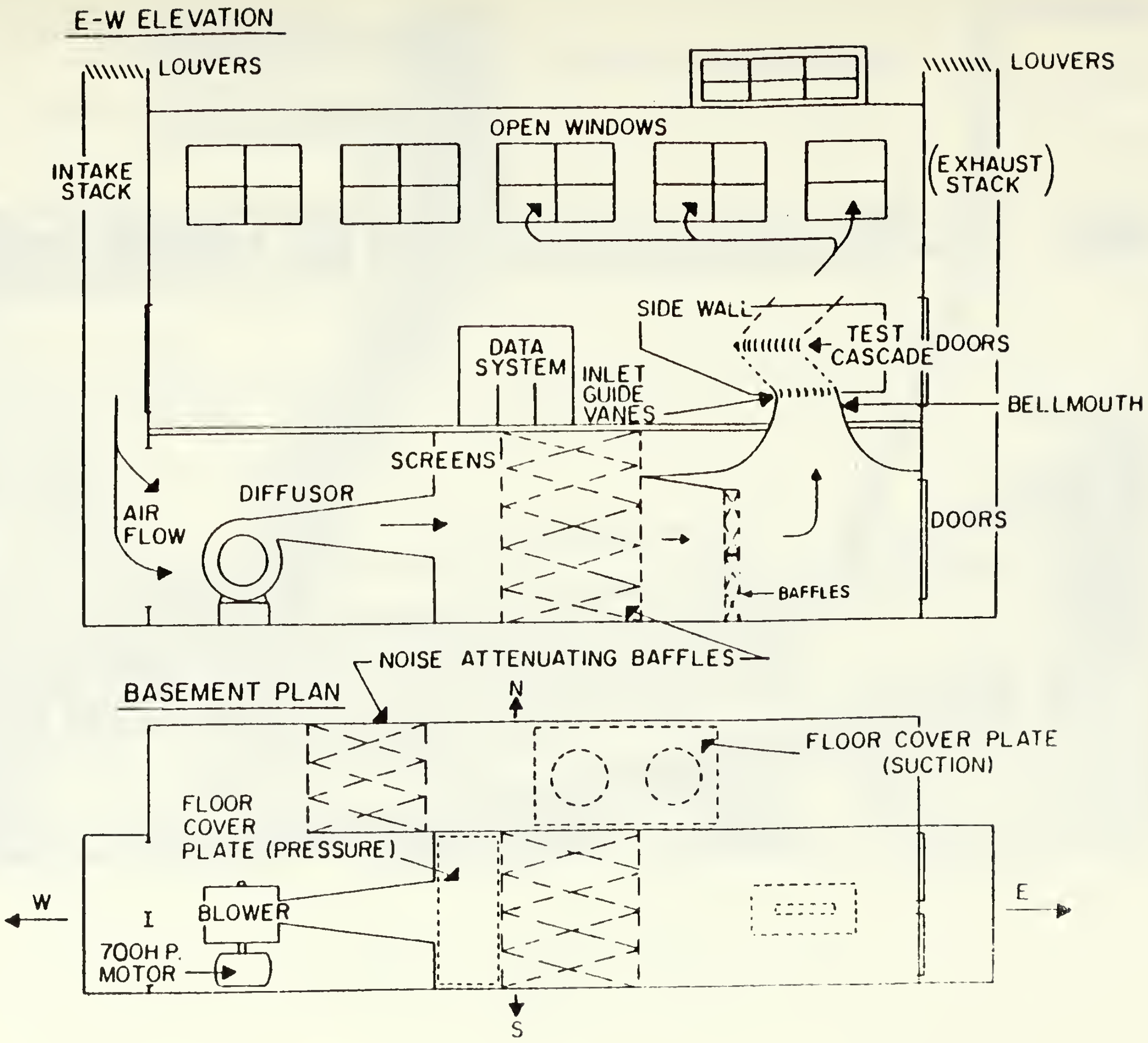


Figure 1. Test Facility Schematic.

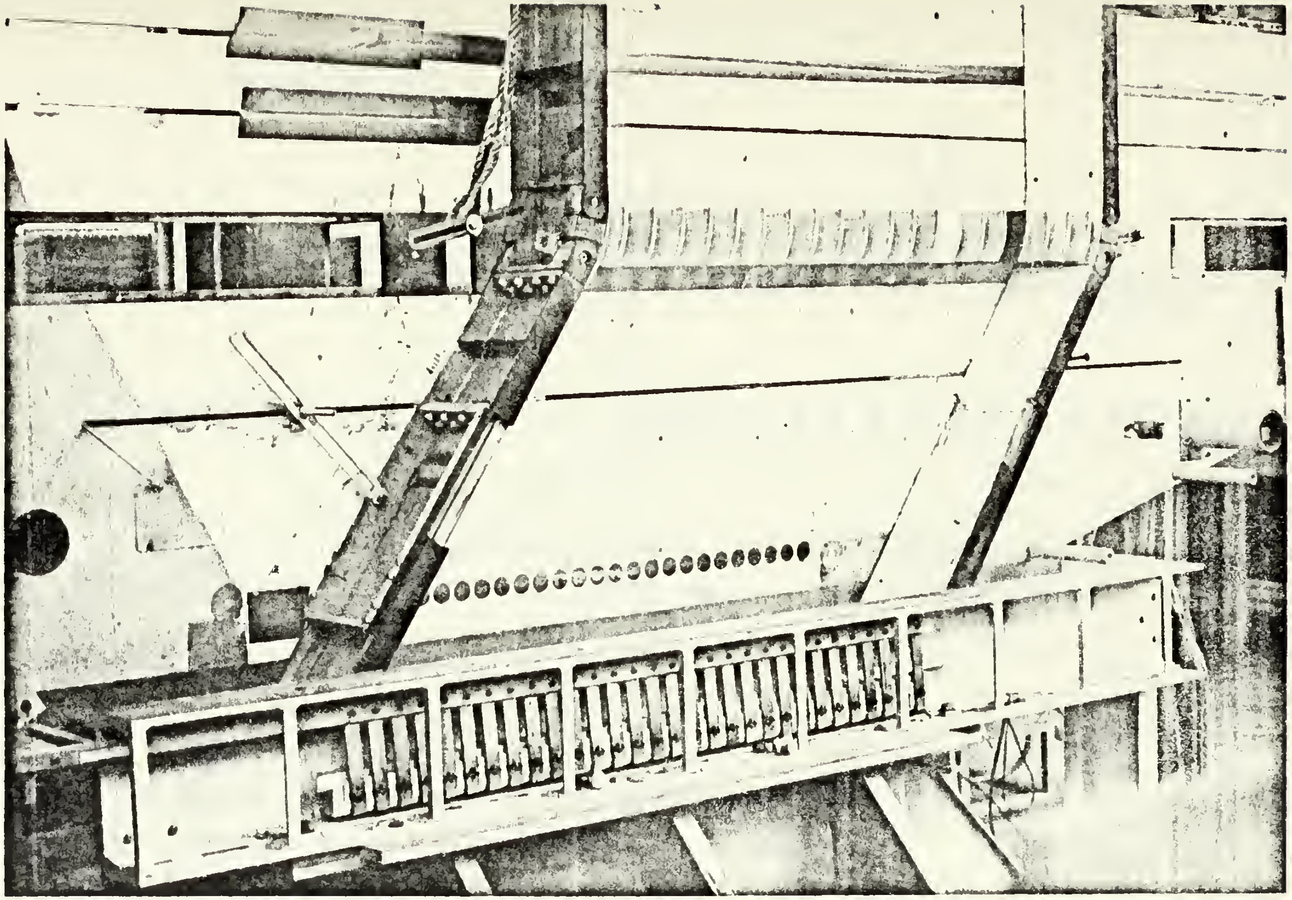


Figure 2. Cascade Test Section.

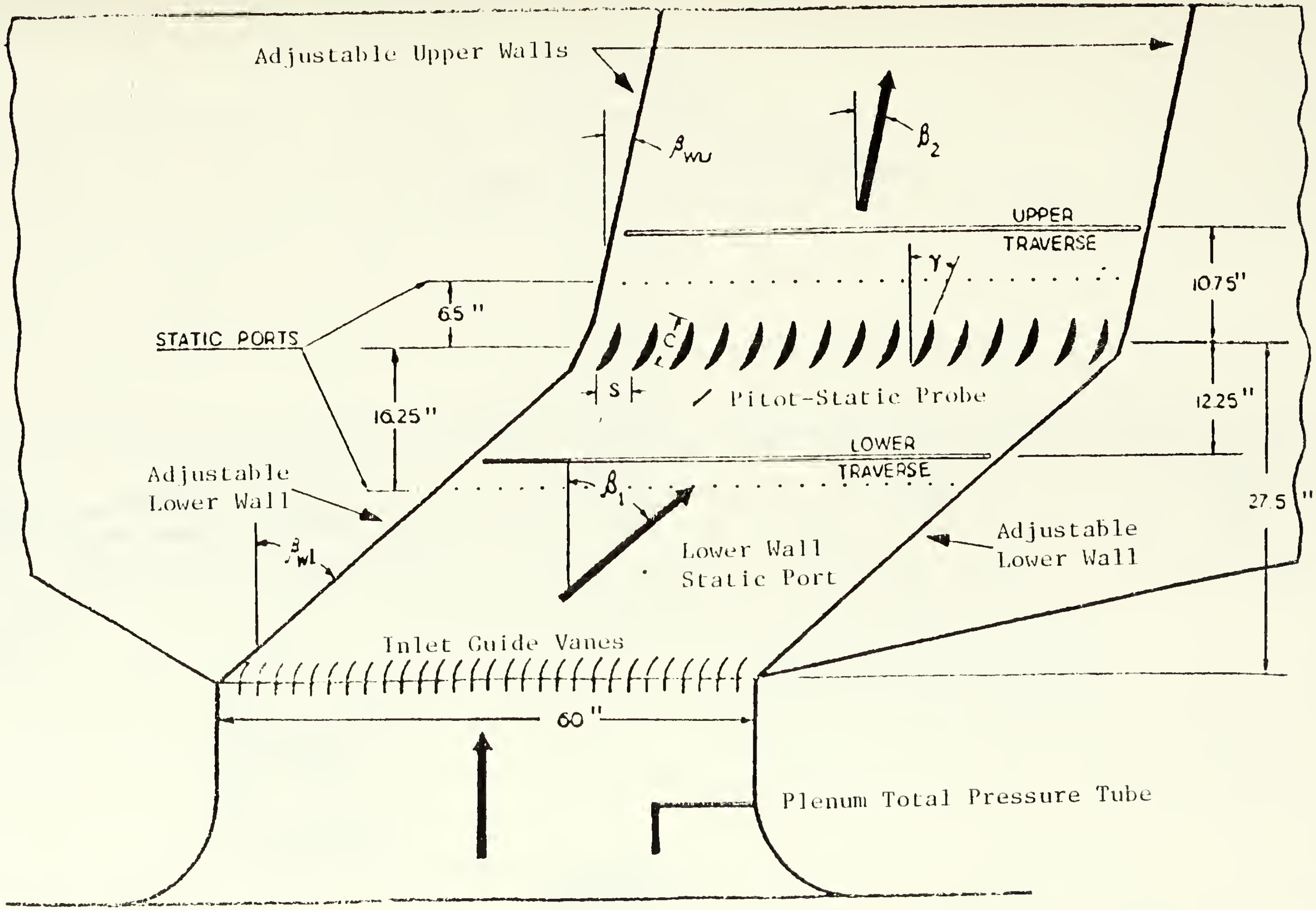


Figure 3. Test Section Instrumentation and Physical Dimensions.

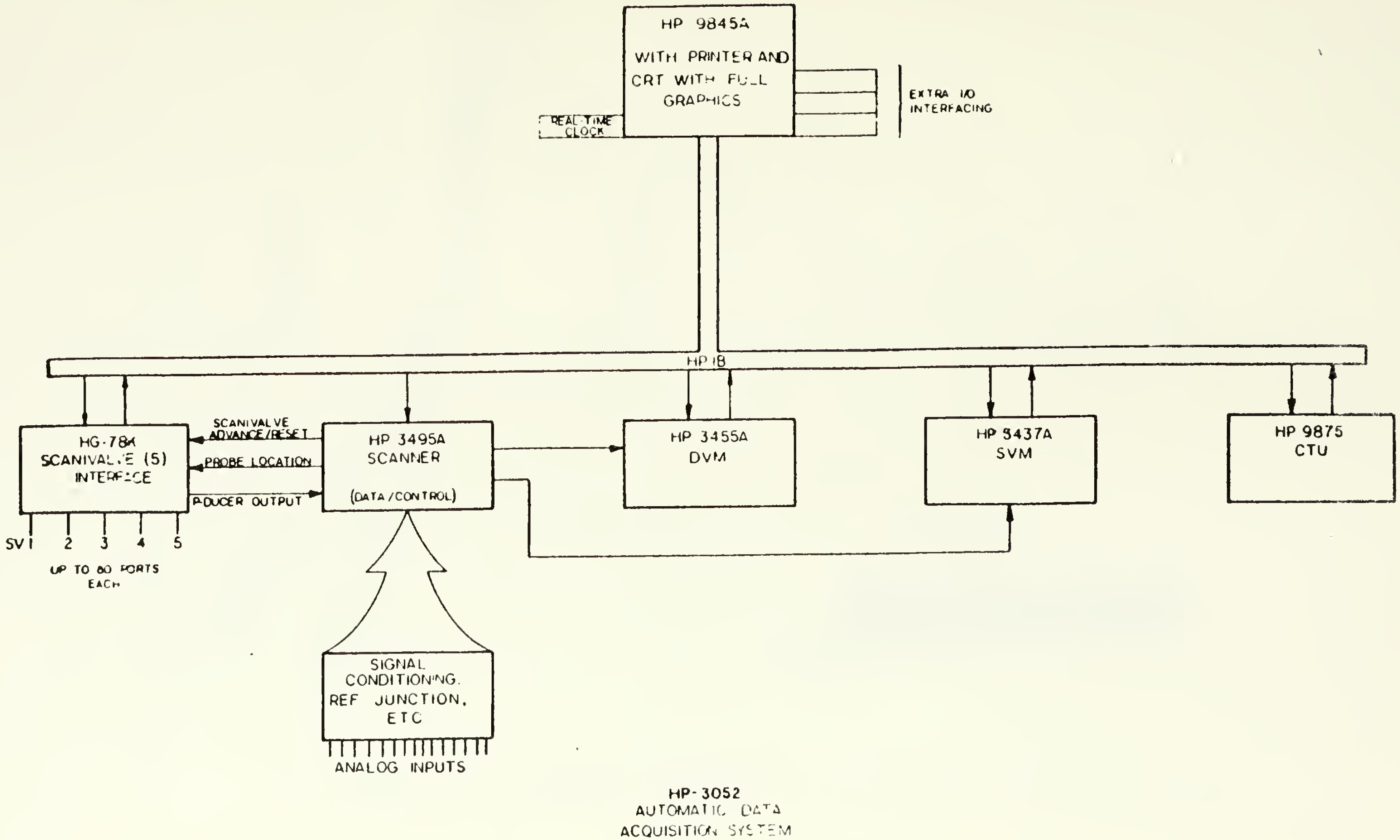


Figure 4. HP-3052 Automatic Data Acquisition System.

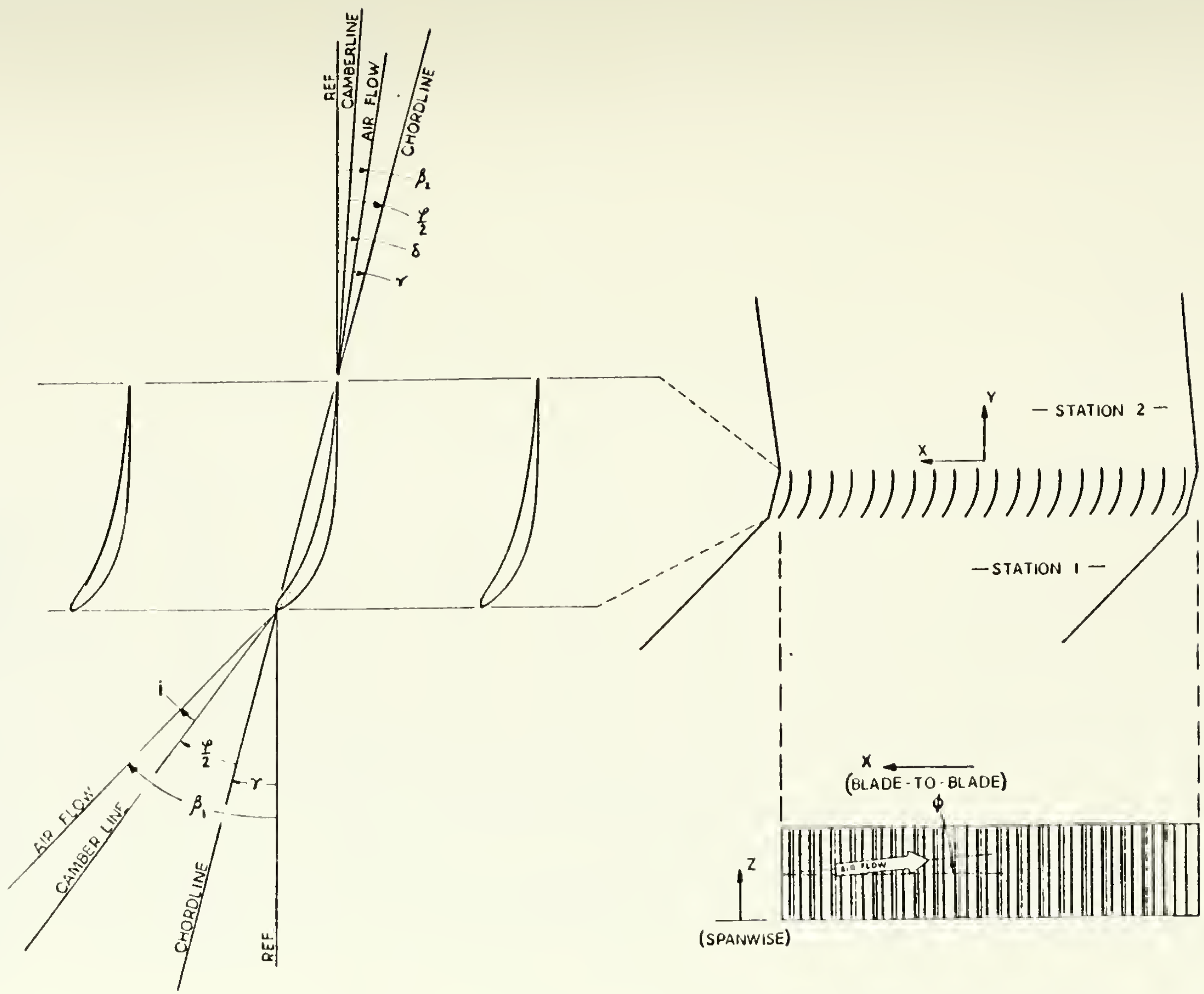


Figure 5. Cascade Geometry, and Definition of Angles.

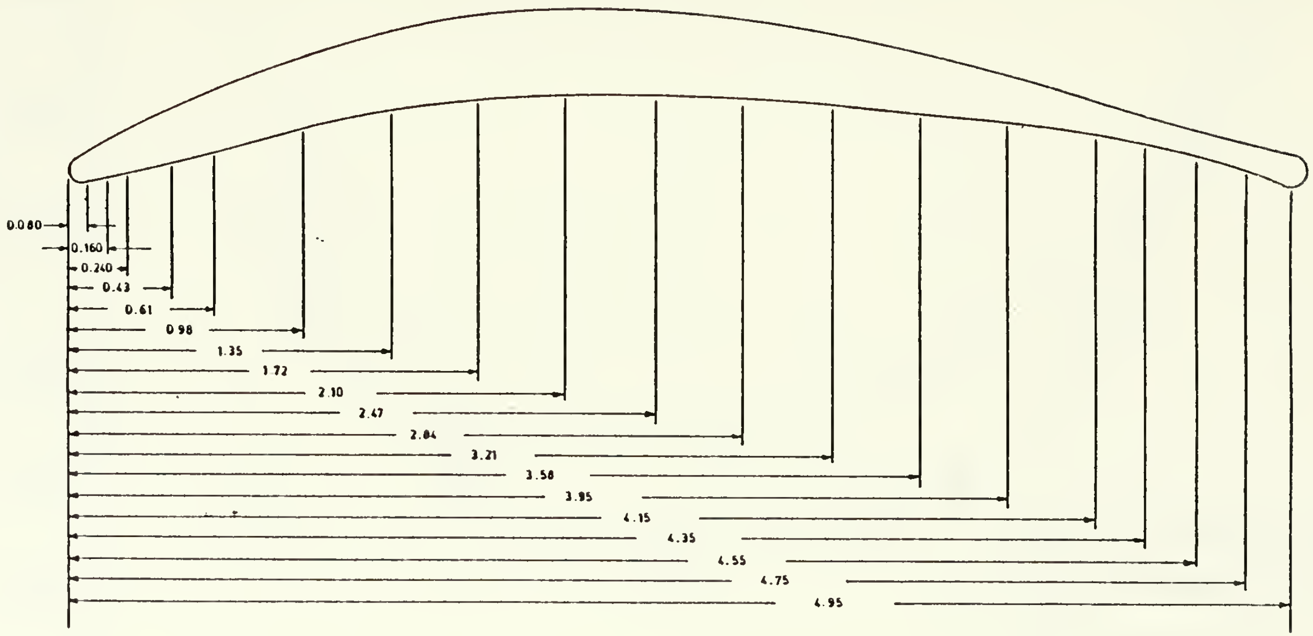


Figure 6. CD Blade Pressure Tap Locations.

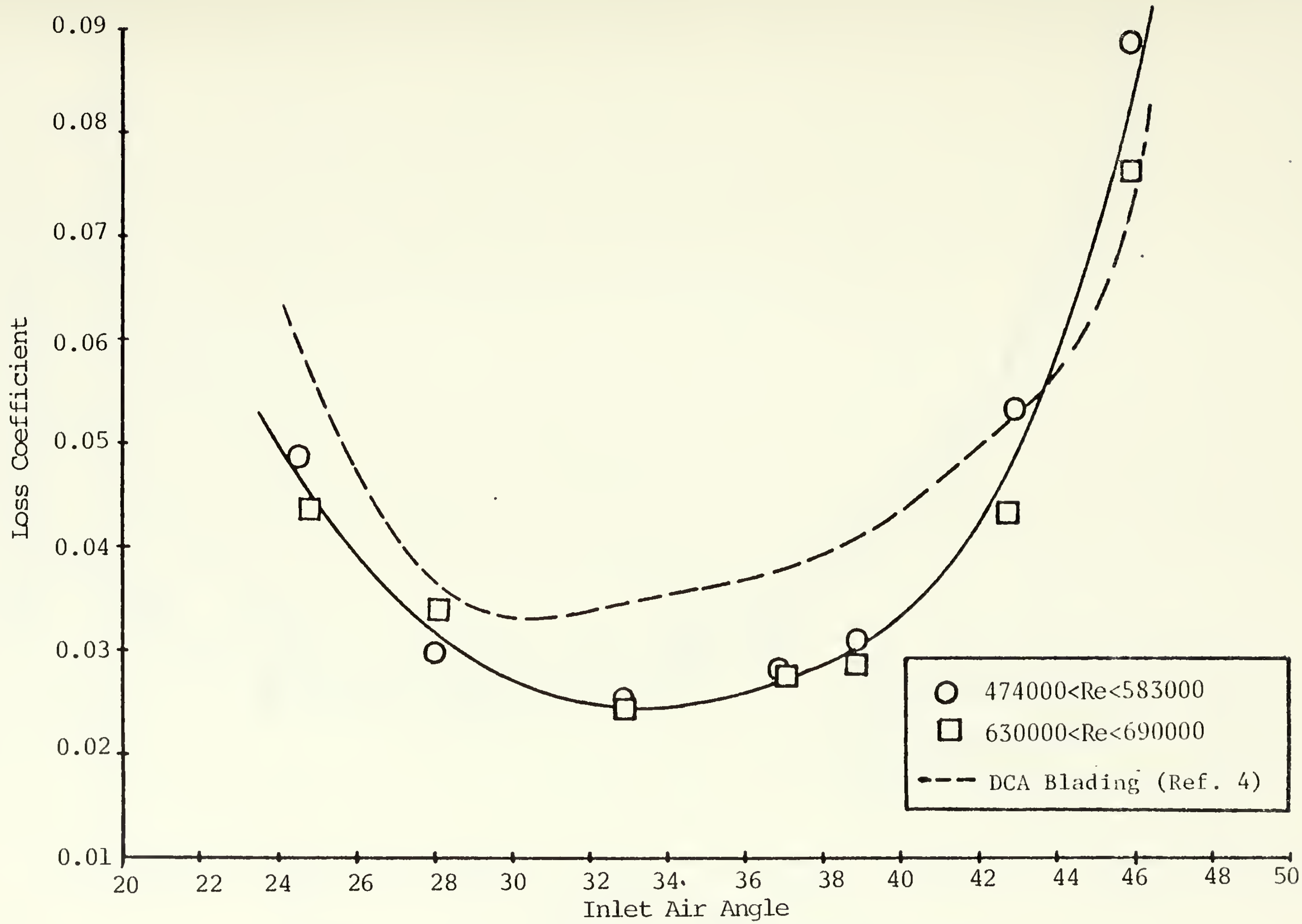


Figure 7. Loss Coefficient Versus Inlet Air angle

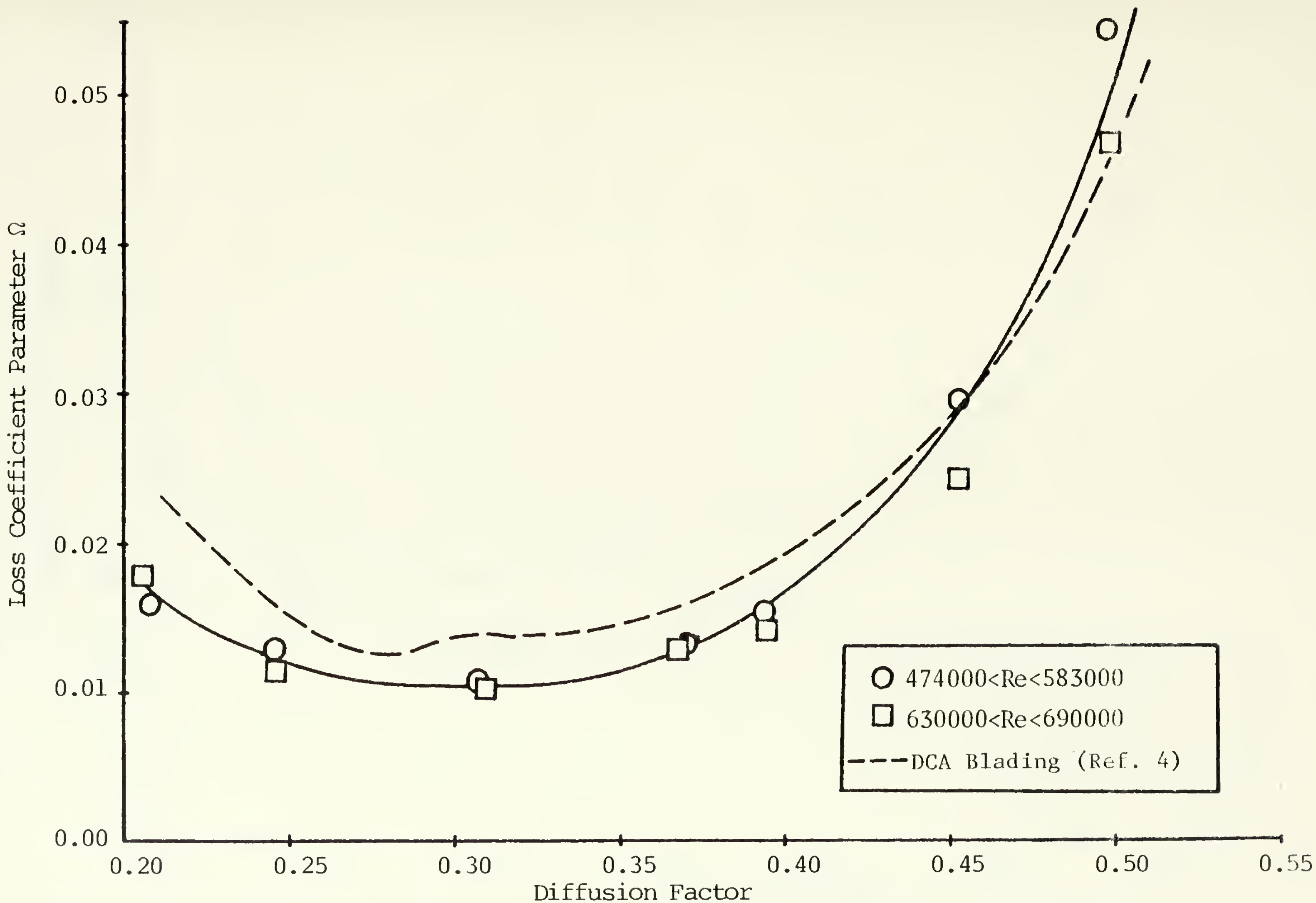


Figure 8. Loss Coefficient Parameter Versus Diffusion Factor

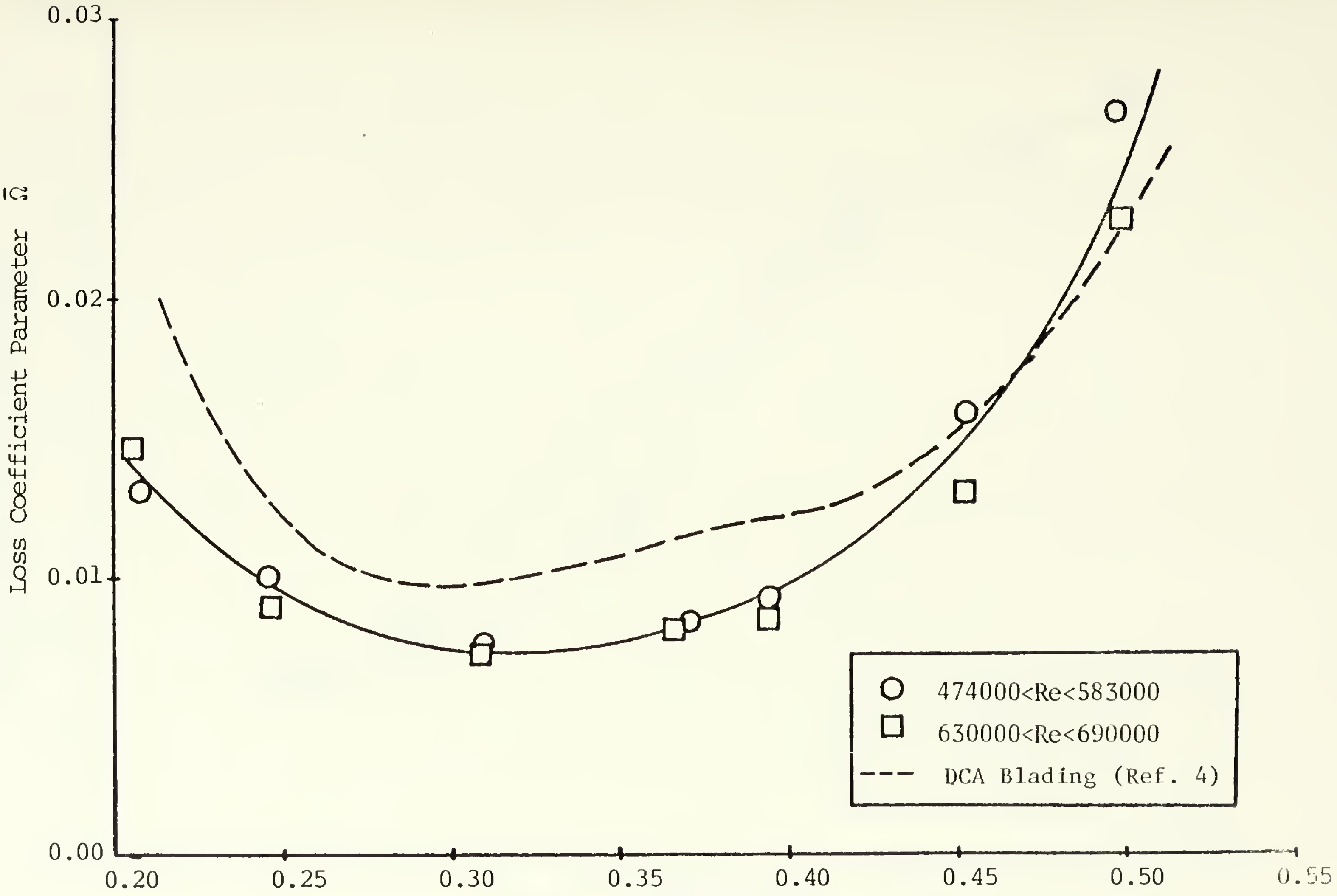


Figure 9. Loss Coefficient Parameter $(\bar{\Omega})$ versus Diffusion Factor.

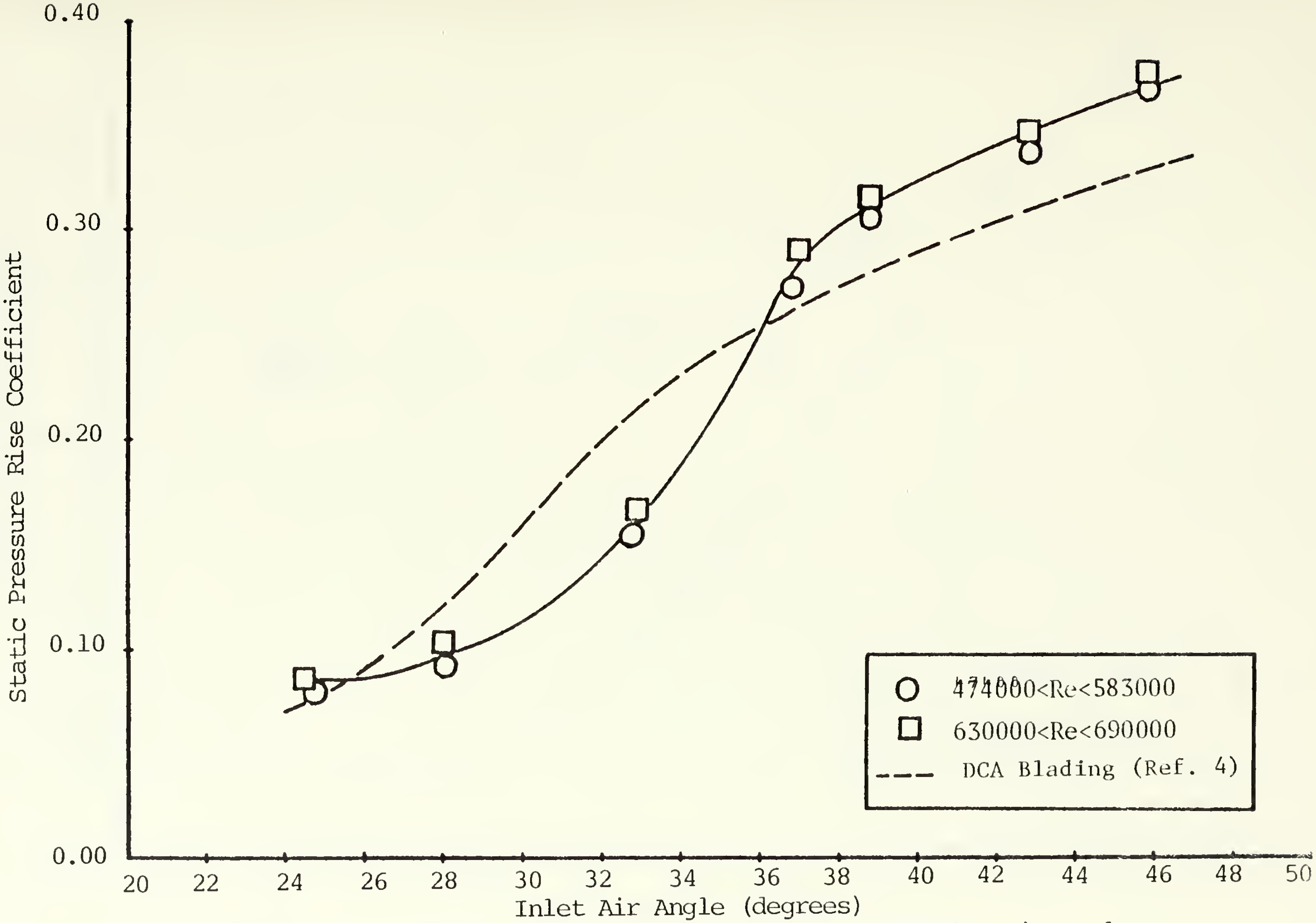


Figure 10. Static Pressure Rise Coefficient Versus Inlet Air Angle

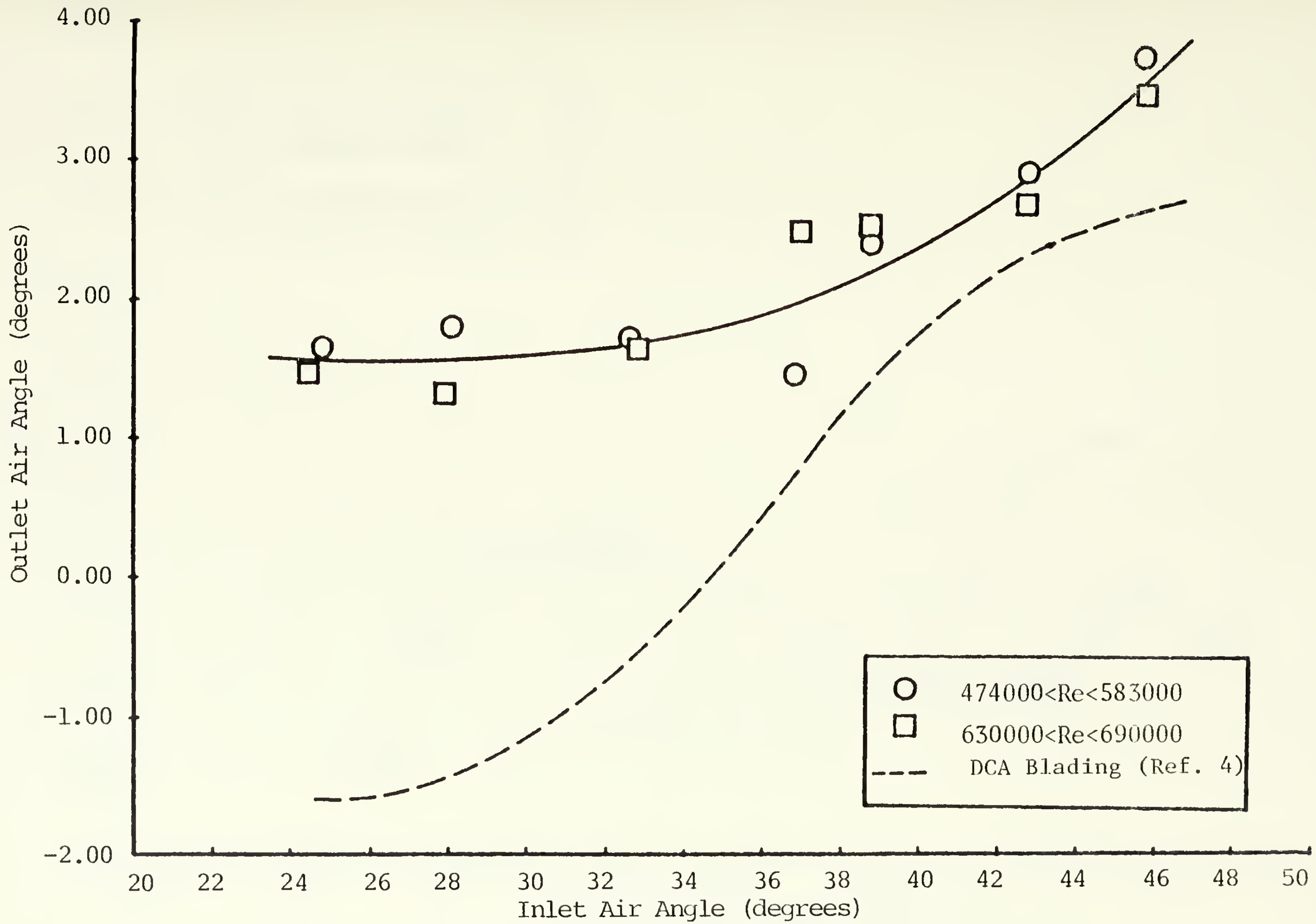


Figure 11. Outlet Air Angle Versus Inlet Air Angle

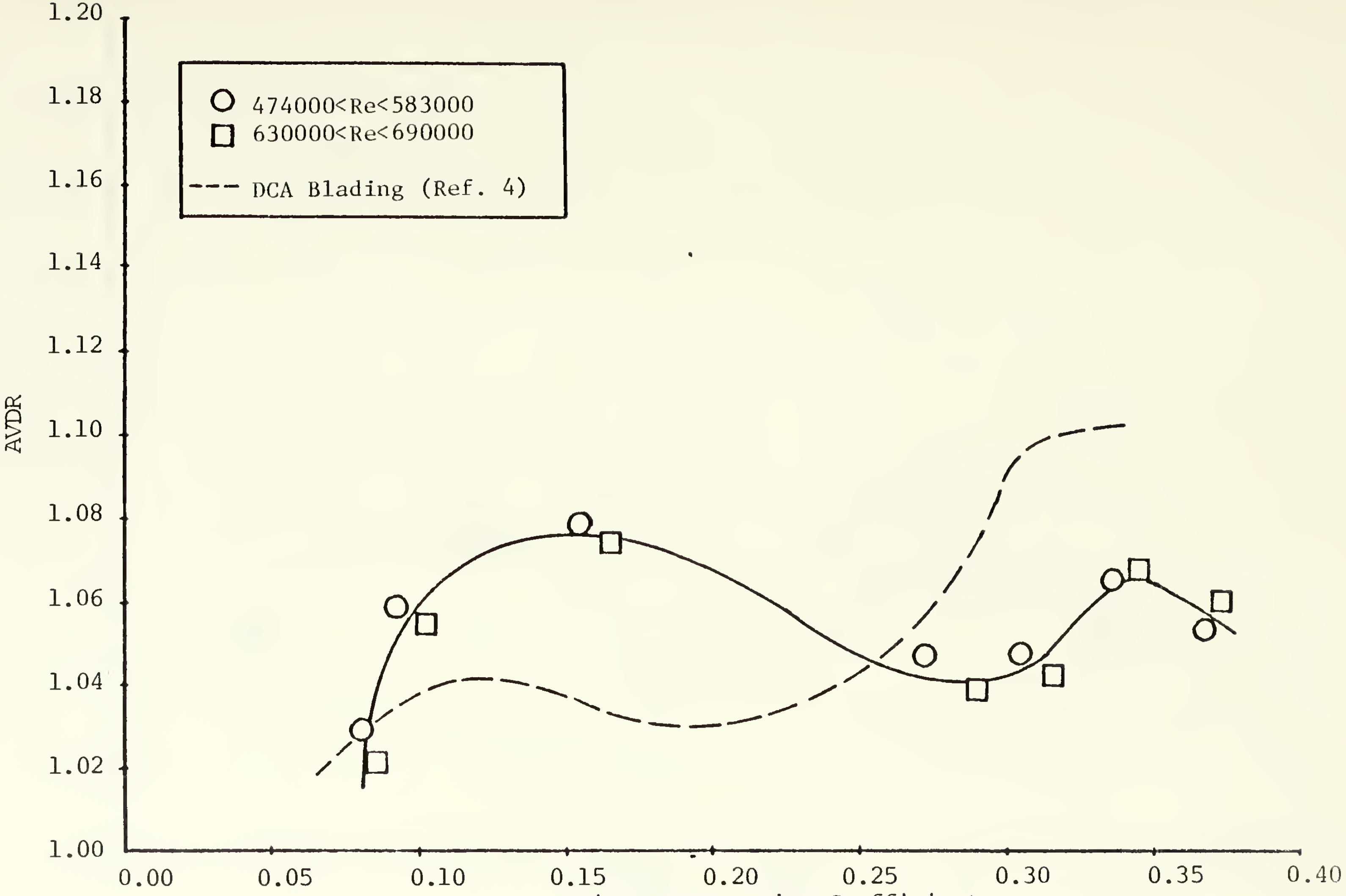


Figure 12. AVDR Versus Static Pressure Rise Coefficient

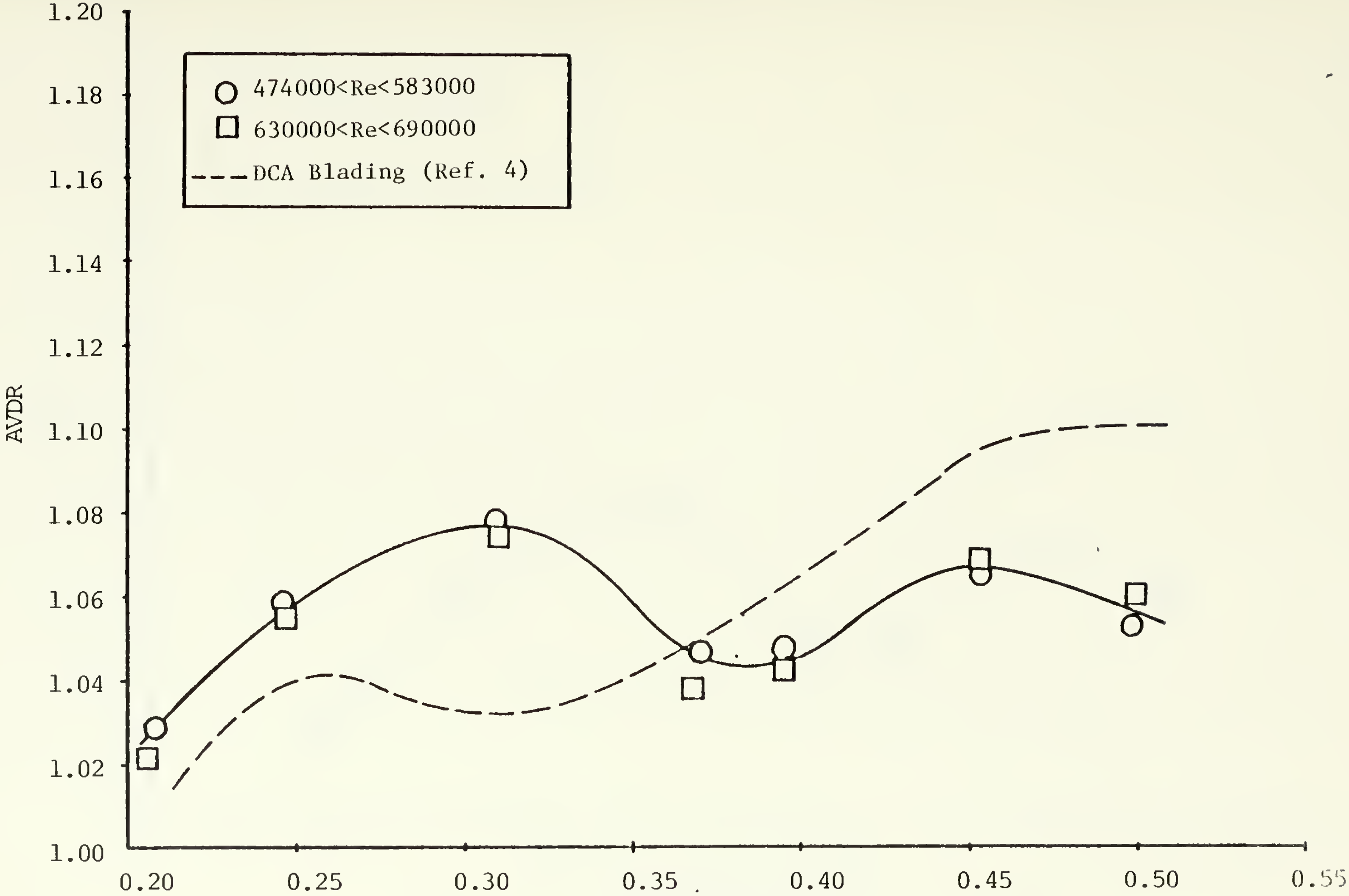


Figure 13. AVDR Versus Diffusion Factor

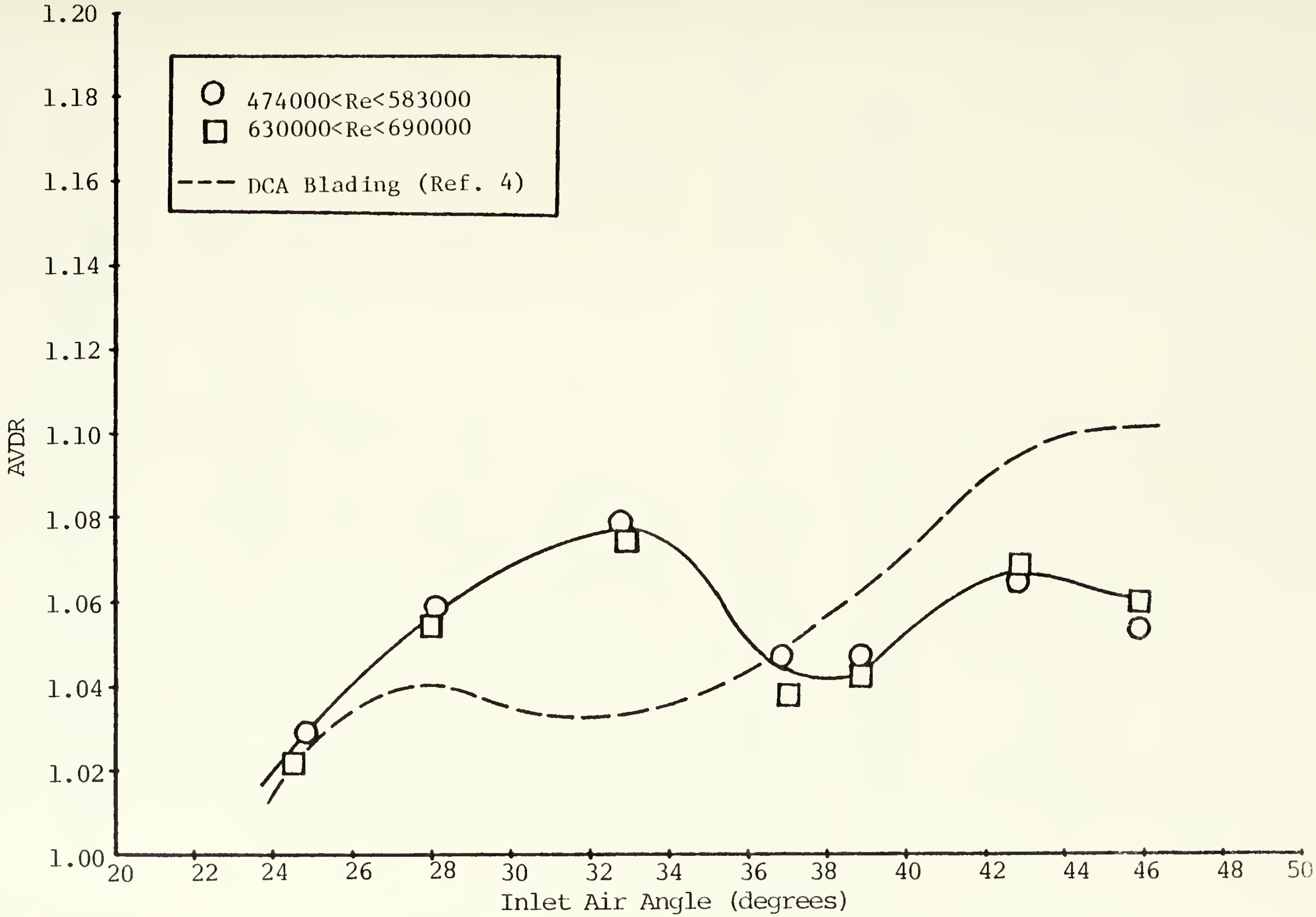


Figure 14. AVDR versus Inlet Air Angle.

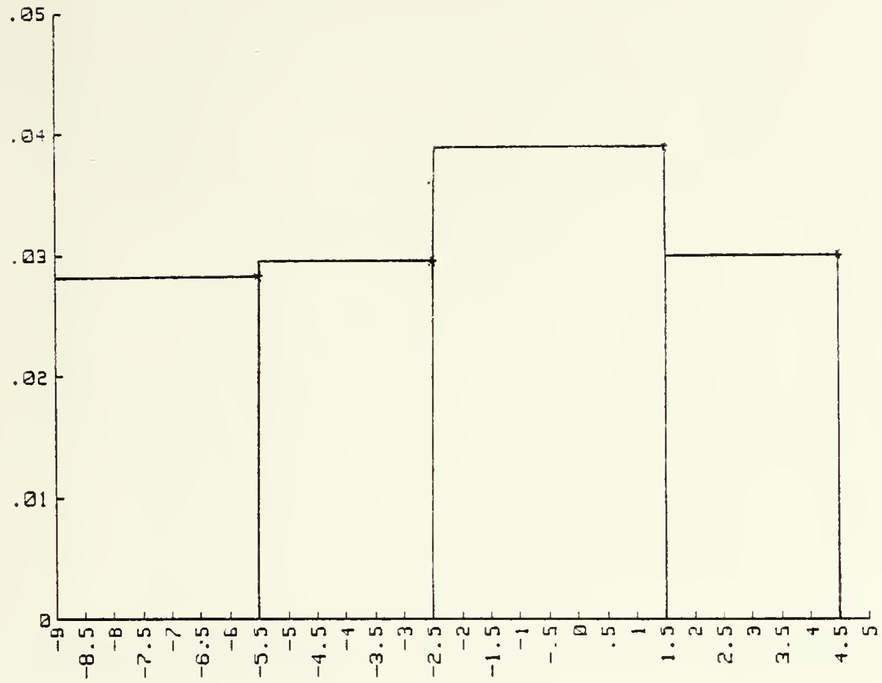


Figure 15 Loss Coefficient vs Blade-to-Blade Position.

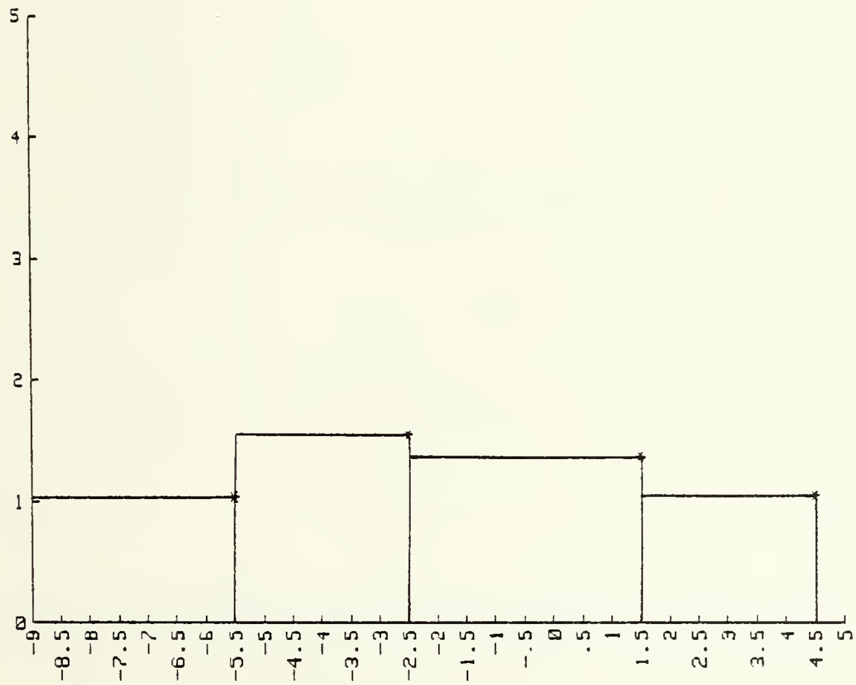


Figure 16 AVDR vs Blade to Blade Position.

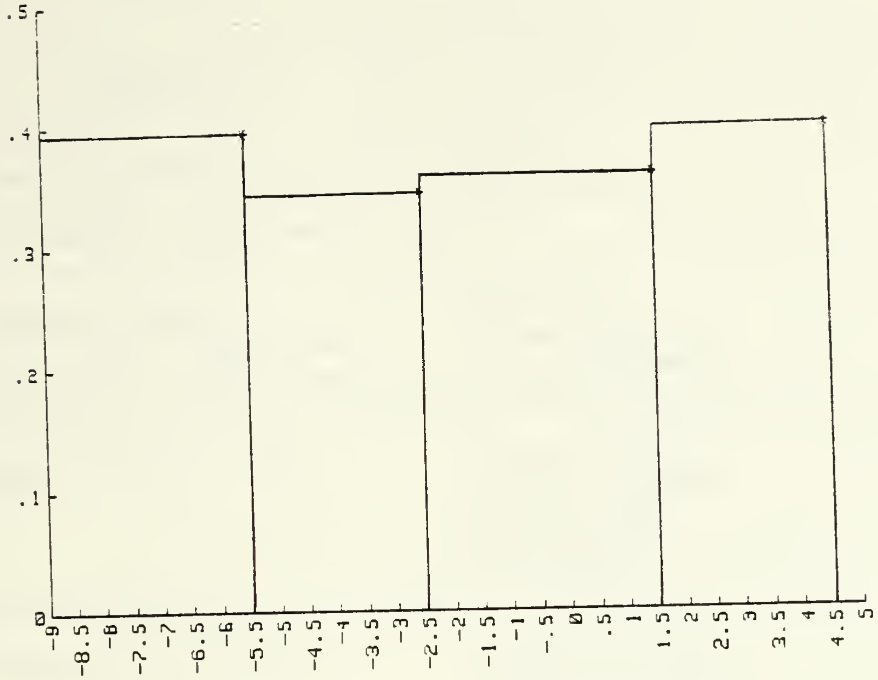


Figure 17 Diffusion Factor vs Blade-to-Blade Position.

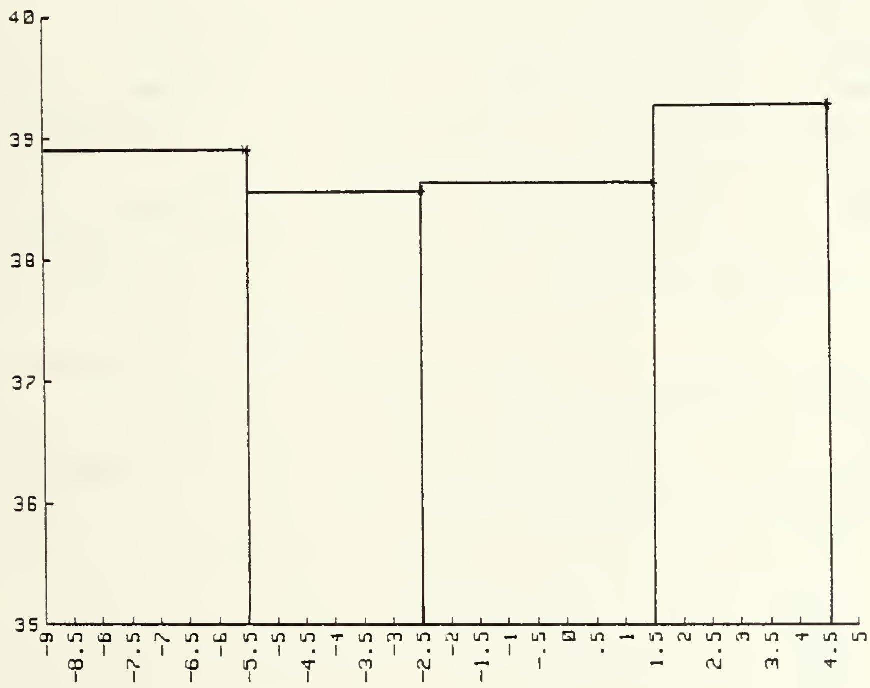


Figure 18 Inlet Air Angle vs Blade-to-Blade Position.

TABLE I. MEASUREMENT UNCERTAINTY

Item	Description	Method	Uncertainty
x	Blade-to-Blade dimension x = 0 in. West end x = 60 in. East end	Position Potentiometer	±.01 in.
z	Spanwise dimension z = 0 in. North wall z = 10 in. South wall	Position Potentiometer on probe mount	±.01 in.
β_1	Inlet flow yaw angle	Angle Potentiometer on probe mount (hand adjustment)	±.2 deg.
β_2	Outlet flow yaw angle	Angle Potentiometer on probe mount (motor driven adjustment)	±.5 deg.
P_{plen}	Plenum total pressure	Static tap in plenum chamber V = 0	±.01 in. H_2O gauge
P_s	Static pressure at the test plane	Calibrated pneumatic probe	±.1 in. H_2O gauge
$P_{w\ell}$	Static pressure at x = 0 in., y = -16.25 in., z = 0 in.	Static tap on North wall	±.01 in. H_2O gauge
P_{ATM}	Atmospheric pressure		
P	Pressure	Scanivalve Transducer	±.01 in. H_2O gauge

TABLE II. CASCADE PERFORMANCE FORMULAS

Parameter	General Expression	Programmed Expression
Loss Coefficient	(Note 1)	(Note 2)
$\overline{\omega}$	$(\overline{C}p_{t_1} - \overline{C}p_{t_2})/(\overline{C}p_{t_1} - \overline{C}p_1)$	$\dfrac{\int_o^s Cp_{t_1}\, k_1\, dx - \frac{1}{AVDR}\int_o^s Cp_{t_2}\, k_2\, dx}{\int_o^s Cp_{t_1}\, k_1\, dx - \int_o^s Cp_1\, k_1\, dx}$
Diffusion Factor		
D	$1 - \dfrac{W_2}{W_1} + \dfrac{\Delta W_u}{2\sigma W_1}$	$1 - \dfrac{\cos\overline{\beta}_1}{\cos\overline{\beta}_2} + \dfrac{\cos\overline{\beta}_1(\tan\overline{\beta}_1 - AVDR(\tan\overline{\beta}_2))}{(1 + AVDR)\sigma}$
Axial Velocity Density Ratio		(Note 2)
AVDR	h_1/h_2	$\dfrac{\int_o^s (\frac{Pt_2}{Pt_{ref}})(\frac{X_2}{X_{ref}})(\frac{1-X_2^2}{1-X_{ref}^2})^{\frac{\gamma}{\gamma-1}} \cos\beta_2\, dx}{\int_o^s (\frac{Pt_1}{Pt_{ref}})(\frac{X_1}{X_{ref}})(\frac{1-X_1^2}{1-X_{ref}^2})^{\frac{\gamma}{\gamma-1}} \cos\beta_1\, dx}$
Static Pressure Rise Coefficient		
Cp_{static}	$\dfrac{\overline{P}_2 - \overline{P}_1}{\overline{P}_{t_1} - \overline{P}_1}$	$\dfrac{\frac{1}{AVDR}\int_o^s Cp_2\, k_2 dx - \int_o^s Cp_1\, k_1\, dx}{\int_o^s Cp_{t_1}\, k_1 dx - \int_o^s Cp_1\, k_1\, dx}$

TABLE II. (continued)

Loss Coefficient Parameter Ω	$\frac{\overline{\omega} \cos^3 \beta_2}{2\sigma \cos^2 \beta_1}$	$\frac{\omega \cos^3 \overline{\beta}_2}{2\sigma \cos^2 \overline{\beta}_1}$
Incidence Angle i	$\beta_1 - \gamma - \phi/2$	$\overline{\beta}_1 - \gamma - \phi/2$
Deviation Angle δ	$\phi/2 - \gamma + \beta_2$	$\phi/2 - \gamma + \overline{\beta}_2$

Note 1: "Barred" quantities are average values computed over a selected integration interval--usually one blade space.

Note 2: Derivation of programmed expression is given in Reference 1.

TABLE III

CASCADE CONFIGURATION PARAMETERS

Constants

Blade type	CD
Number of blades	20
Spacing (inches)	3.0
Solidity	1.67
Thickness (% chord)	7.0
Stagger angle	14.27

TABLE IV TEST BLADE COORDINATES

X-COORD.	Y-PRESS.	Y-SUCT.
0.0	0.045	0.045
0.022	-----	0.084
0.057	0.002	-----
0.222	0.044	0.196
0.444	0.101	0.307
0.666	0.155	0.403
0.888	0.207	0.488
1.110	0.255	0.561
1.332	0.299	0.621
1.554	0.330	0.663
1.776	0.350	0.691
1.998	0.359	0.705
2.220	0.359	0.708
2.442	0.352	0.701
2.664	0.342	0.681
2.886	0.331	0.650
3.108	0.317	0.610
3.330	0.301	0.563
3.552	0.281	0.510
3.774	0.257	0.453
3.996	0.227	0.393
4.218	0.191	0.332
4.440	0.146	0.270
4.662	0.089	0.208
4.884	0.019	0.145
4.925	0.004	-----
4.964	-----	0.122
5.010	0.062	0.062

TABLE V (Cont)

FLOW UNIFORMITY SUMMARY

(/-) shows the maximum positive and negative deviation of the tabulated uniformity parameter with respect to its average value computed over the distance indicated.

Inlet Plane: Mid 20% of span

B_1(°)	Q/Q_{ref}(%)	$\Delta P_s/Q_{ref}$(%)	$\Delta P_t/Q_{ref}$(%)	X/X_{ref}(%)	BETA (%)
24.8	(0.4/-0.4)	(11/-7.6)	(4.4/-5.5)	(0.2/-2.7)	(0.4/-1.5)
24.5	(0.4/-0.5)	(3.2/-1.7)	(2.9/-3.9)	(0.2/-0.2)	(0.3/-0.7)
28.12	(1.2/-1.2)	(15.0/-8.4)	(10.7/-10.3)	(0.5/-0.5)	(0.3/-0.6)
28.00	(0.8/-0.9)	(13.7/-26.3)	(14.0/12.9)	(0.4/-0.5)	(0.7/-0.5)
32.87	(0.0/0.0)	(4.6/-9.3)	(1.7/-1.7)	(0.0/-0.1)	(0.1/-0.3)
32.95	(0.2/-0.2)	(7.6/-3.0)	(4.4/-4.9)	(0.0/-0.1)	(0.6/-0.3)
37.07	(0.3/-0.1)	(7.1/-7.0)	(3.2/-4.2)	(0.0/0.0)	(0.2/-0.6)
36.91	(0.1/-0.3)	(9.7/-9.1)	(7.5/-5.4)	(0.3/-0.4)	(0.5/-0.2)
38.89	(0.2/-0.1)	(7.2/-13.6)	(1.5/-1.2)	(0.0/0.0)	(0.5/-0.7)
38.91	(0.5/-0.4)	(4.2/-4.8)	(4.4/-4.0)	(0.2/-0.2)	(0.6/-0.4)
42.92	(0.5/-0.4)	(4.3/-10.0)	(5.5/-7.6)	(0.1/-0.1)	(0.3/-0.3)

TABLE V (Cont)

Inlet Plane: Mid 20% of span

B_1(°)	Q/Q_{ref}(%)	$\Delta P_s/Q_{ref}$(%)	$\Delta P_t/Q_{ref}$(%)	X/X_{ref}(%)	BETA (%)
42.90	(0.7/-0.9)	(5.5/-8.7)	(9.9/-8.6)	(0.5/-0.6)	(0.4/-0.2)
45.90	(0.7/-0.8)	(8.7/-1818)	(6.2/-6.4)	(0.4/-0.7)	(0.1/-0.4)
45.96	(0.7/-0.8)	(8.7/-18.8)	(6.2/-6.4)	(0.4/-0.7)	(0.1/-0.4)

TABLE V (Cont)

Outlet Plane: Mid 20% of span

B_i (°)	Q/Q_{ref} (%)	$\Delta P_s/Q_{ref}$ (%)	$\Delta P_f/Q_{ref}$ (%)	X/X_{ref} (%)	BETA (%)
24.8	(0.5/-0.4)	(4.5/-5.0)	(4.1/-5.0)	(0.3/-0.1)	(0.2/-1.0)
24.5	(0.6/-0.7)	(4.8/-2.1)	(6.0/-3.2)	(0.2/-0.3)	(6.6/-2.2)
28.12	(0.4/-0.5)	(1.1/-1.2)	(3.9/-3.5)	(0.2/-0.3)	(0.7/-0.4)
28.00	(0.6/-0.2)	(1.1/-2.0)	(6.0/-5.7)	(0.1/-0.2)	(0.8/-0.8)
32.87	(0.3/-0.4)	(1.7/-1.1)	(6.5/-3.6)	(0.3/-0.4)	(0.6/-1.1)
32.95	(0.8/-0.4)	(1.1/-0.9)	(2.6/-5.2)	(0.4/-0.3)	(3.4/-2.9)
37.07	(0.0/-0.4)	(0.9/-0.7)	(3.2/-3.4)	(0.2/-0.3)	(10.6/-9.8)
36.91	(0.3/-0.2)	(1.1/-0.4)	(5.1/-4.3)	(0.3/-0.4)	(2.5/-1.8)
38.89	(0.4/-0.2)	(0.5/-0.5)	(1.1/-2.4)	(0.3/-0.1)	(7.7/-7.5)
38.91	(0.3/-0.4)	(0.3/-0.8)	(1.3/-1.1)	(0.2/-0.1)	(1.6/-3.9)
42.92	(0.7/-0.5)	(0.2/-0.2)	(3.3/-3.9)	(0.3/-0.3)	(0.3/-0.5)
42.90	(0.3/-0.4)	(0.7/-0.5)	(3.6/-2.5)	(0.2/-0.2)	(0.3/-0.5)
45.90	(2.9/-5.7)	(0.9/-1.7)	(19.2/-10.4)	(1.5/-2.7)	(0.5/-0.3)
45.96	(2.7/-2.9)	(2.8/-1.1)	(11.5/-9.9)	(1.5/-1.4)	(0.4/-0.4)

TABLE V (Cont)

Inlet Plane: -3 to 0 blade-to-blade direction

B_1(°)	Q/Q_{ref}(%)	$\Delta P_s/Q_{ref}$(%)	$\Delta P_t/Q_{ref}$(%)	X/X_{ref}(%)	BETA (%)
24.8	(2.2/-1.6)	(4.1/-2.0)	(1.3/-1.8)	(1.1/-0.1)	(0.8/-1.3)
24.5	(1.5/-1.5)	(8.9/-8.5)	(1.2/-13.0)	(0.7/-0.7)	(1.0/-1.0)
28.12	(2.6/-2.0)	(9.9/-7.6)	(1o.2/-11.0)	(1.4/-0.8)	(0.8/-0.9)
28.00	(2.0/-1.7)	(32.4/-22.0)	17.9/-21.7)	(1.o/-0.8)	(1.2/-0.6)
32.87	(1.5/-2.5)	(27.2/-22.0)	(14.7/-10.6)	(0.6/-0.6)	(0.7/-08.)
32.95	(1.5/-1.3)	(31.0/-22.8)	(17.5/-8.8)	(0.8/-0.6)	(1.2/-1.1)
37.07	(1.3/-1.5)	(8.4/-10.0)	(10.6/-12.0)	(0.4/-0.6)	(0.5/-0.9)
36.91	(0.9/-0.8)	(38.4/-24.8)	(8.7/-10.1)	(0.5/-0.5)	(0.8/-0.5)
38.89	(1.3/-1.1)	(25.9/-29.8)	(8.2/-10.2)	(0.6/-0.5)	(0.5/-0.5)
38.91	(1.4/-0.9)	(8.4/-10.5)	(9.5/-13.0)	(0.4/-0.4)	(0.4/-0.9)
42.92	(7.1/-4.8)	(38.3/-21.3)	(3.8/-4.9)	(0.6/-0.4)	(0.2/-0.4)
42.90	(0.4/-1.0)	(12.3/-39.6)	(11.1/-7.4)	(0.5/-0.5)	(0.5/-0.6)
45.90	(0.6/-0.6)	(24.4/-16.0)	(5.6/-5.9)	(0.2/-0.3)	(0.7/-0.7)
45.96	(1.4/-1.5)	(11.8/-22.8)	(12.8/-8.1)	(0.4/-0.6)	(0.2/-0.4)

TABLE VI

CASCADE PERFORMANCE SUMMARY

i	β_2	D	ω	$\frac{\omega\cos^3\beta_2}{2\sigma\cos^2\beta_1}$	$\frac{\omega\cos\beta_2}{2\sigma}$	AVDR	Cp_{static}	Cx_M	Cy_M	Cx_B	Cy_B	Re
24.49	1.46	0.206	.0488	0.0176	0.0146	1.0209	.0854	-.7035	-.0861	-.741	-.211	690000
24.80	1.65	0.208	.0438	0.0159	0.0131	1.0291	.0798	-.6825	-.0409	-.767	-.249	526000
28.00	1.31	0.247	.0298	0.0114	0.0039	1.0544	.1026	-.7978	-.1171	-.883	-.277	648000
28.12	1.80	0.246	.0337	0.0130	0.0101	1.0586	.0919	-.7650	-.0745	-.914	-.316	495000
32.95	1.64	0.310	.0241	0.0102	0.0072	1.0738	.1655	-.9395	-.2371	-1.054	-.377	630000
32.87	1.65	0.309	.0251	0.0106	0.0106	1.0784	.1542	-.9117	.3531	-1.050	-.409	474000
36.91	1.45	0.370	.0277	0.0130	0.0083	1.0469	.2719	-1.135	-.4806	-1.183	-.518	516000
37.07	2.47	0.368	.0273	0.0129	0.0082	1.0380	.2898	-1.144	-.1918	-1.162	-.417	683000
38.91	2.50	0.395	.0285	0.0140	0.0085	1.0424	.3159	-1.202	-.3685	-1.216	-.525	676000
38.89	2.38	0.395	.0310	0.0153	0.0093	1.0474	.3043	-1.178	-.0692	-1.234	-.574	530000
42.90	2.66	0.453	.0434	0.0242	0.0130	1.0677	.3451	-1.294	-.5194	-1.329	-.644	686000
42.92	2.88	0.453	.0533	0.0296	0.0159	1.0652	.3359	-1.262	-.3077	-1.344	-.671	583000
45.96	3.44	0.500	.0760	0.0468	0.0227	1.0600	.3735	-1.342	-.5109	-1.393	-.721	690000
45.90	3.72	0.498	.0886	0.0545	0.0265	1.0532	.3673	-1.306	-.0424	-1.470	-.762	506000

TABLE VII

DISTRIBUTION OF PERFORMANCE PARAMETERS IN THE BLADE-TO-BLADE DIRECTION

```
UPPER PLANE DATA FROM FILE BD3319
LOWER PLANE DATA FROM FILE BD3319
INTEGRATION FROM:   -8.5
            TO:  -5.5

LOSS COEFFICIENT:          2.82951311684E-02
INLET AIR ANGLE:           38.9097
OUTLET AIR ANGLE:          2.56561
DIFFUSION FACTOR:          .394644822359
STATIC PR. RISE COEF.      .317376812872
TANGENTIAL FORCE COEF.X -1.1996132
AXIAL FORCE COEF.Y        -.535691612288
INCIDENCE ANGLE:           1.7797
DEVIATION ANGLE:           11.15561
LOSS COEFFICIENT
        PARAMETER:         8.46310437910E-03
AXIAL VELOCITY-DENSITY
       RATIO (AVDR):      1.04166509828
CFA, 1st term:             1.6475912693
CFA, 2nd term:             1.70682
CFA, 3rd term:             39.817
CFA, 4th term:             40.3036
CFA, 5th term:            -1.01371184115E-02
```

```
UPPER PLANE DATA FROM FILE BD3319
LOWER PLANE DATA FROM FILE BD3319
INTEGRATION FROM:   -5.5
            TO:  -2.5

LOSS COEFFICIENT:          2.95907328674E-02
INLET AIR ANGLE:           38.5739
OUTLET AIR ANGLE:          3.58318
DIFFUSION FACTOR:          .345149777579
STATIC PR. RISE COEF.      .318197038385
TANGENTIAL FORCE COEF.X -1.15955
AXIPL FORCE COEF.Y        -14.9566072223
INCIDENCE ANGLE:           1.4439
DEVIATION ANGLE:           12.17318
LOSS COEFFICIENT
        PARAMETER:         8.84218158437E-03
AXIAL VELOCITY-DENSITY
       RATIO (AVDR):      1.55183861658
CFA, 1st term:             2.4630006603
CFA, 2nd term:             2.53555
CFA, 3rd term:             39.8542
CFA, 4th term:             60.41
CFA, 5th term:            -5.67174211735
```

```
UPPER PLANE DATA FROM FILE BD3319
LOWER PLANE DATA FROM FILE BD3319
INTEGRATION FROM:·  -2.5
            TO:   1.5

LOSS COEFFICIENT:          3.90277574332E-02
INLET AIR ANGLE:           38.6422
OUTLET AIR ANGLE:          3.25217
DIFFUSION FACTOR:          .360025937117
STATIC PR. RISE COEF.      .317045622555
TANGENTIAL FORCE COEF.X -1.1731427
AXIAL FORCE COEF.Y        -11.0035152095
INCIDENCE ANGLE:           1.5122
DEVIATION ANGLE:           11.84217
LOSS COEFFICIENT
        PARAMETER:         1.16661389572E-02
AXIAL VELOCITY-DENSITY
       RATIO (AVDR):      1.37091719401
CFA, 1st term:             2.17571413275
CFA, 2nd term:             2.22715
CFA, 3rd term:             39.8644
CFA, 4th term:             53.3101
CFA, 5th term:            -2.49362065775
```

```
UPPER PLANE DATA FROM FILE BD3319
LOWER PLANE DATA FROM FILE BD3319
INTEGRATION FROM:    1.5
            TO:   4.5

LOSS COEFFICIENT:          3.01525363151E-02
INLET AIR ANGLE:           39.2907
OUTLET AIR ANGLE:          2.31981
DIFFUSION FACTOR:          .39853183075
STATIC PR. RISE COEF.      .314836492943
TANGENTIAL FORCE COEF.X -1.1942644
AXIAL FORCE COEF.Y        -.35936653286
INCIDENCE ANGLE:           2.1607
DEVIATION ANGLE:           11.40981
LOSS COEFFICIENT
        PARAMETER:         9.01677462820E-03
AXIAL VELOCITY-DENSITY
       RATIO (AVDR):      1.0486244959
CFA, 1st term:             1.63906300456
CFA, 2nd term:             1.70826
CFA, 3rd term:             39.318
CFA, 4th term:             39.6154
CFA, 5th term:            -7.23046254033E-03
```

APPENDIX A

FLOW QUALITY DOCUMENTATION

1. Uniformity and Periodicity

Periodicity for blade-to-blade surveys and uniformity of dynamic pressure (Q/Q_{ref}), static pressure ($\Delta P_s/Q_{ref}$), total pressure ($\Delta P_t/Q_{ref}$), non-dimensional velocity (X/X_{ref}), and Beta for spanwise and blade-to-blade surveys at the inlet and outlet planes are documented in Tables A-1 through A-128 and shown in Figures A-1 through A-169. The notation for these results is as follows:

Q/Q_{ref}	local value of Q/Q_{ref}
$\Delta P_s/Q_{ref}$	$(P_s - P_{w\ell})/Q_{ref}$
$\Delta P_t/Q_{ref}$	$(P_{plen} - P_t)/Q_{ref}$
X/X_{ref}	local value of X/X_{ref}

Reference values, Q_{ref} and X_{ref} were based on plenum stagnation pressure, P_{plen} and lower wall static pressure, $P_{w\ell}$.

2. Blade Surface Pressure Distributions

Surface pressure coefficients are plotted in Figures 141-154 and the data are listed with each probe survey data set in the tables. The values of C_p were calculated as the difference between local surface pressure and upstream mass-averaged static pressure divided by mass averaged upstream dynamic pressure. The mass-averaged values were obtained by integrating lower plane probe survey data over one blade space.

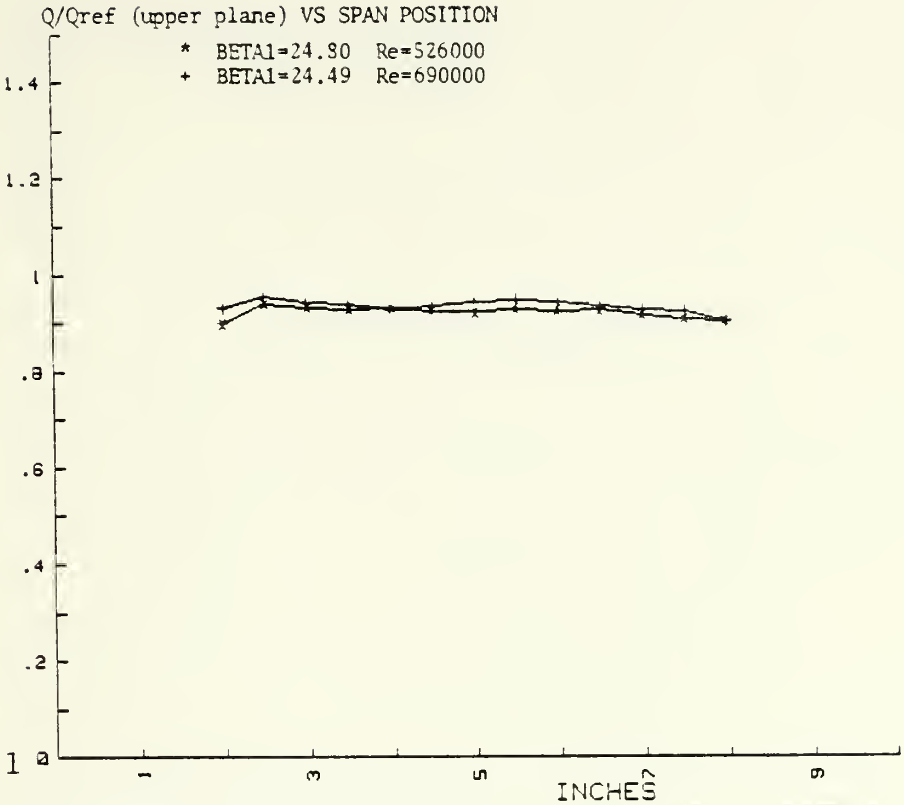


Figure A-1

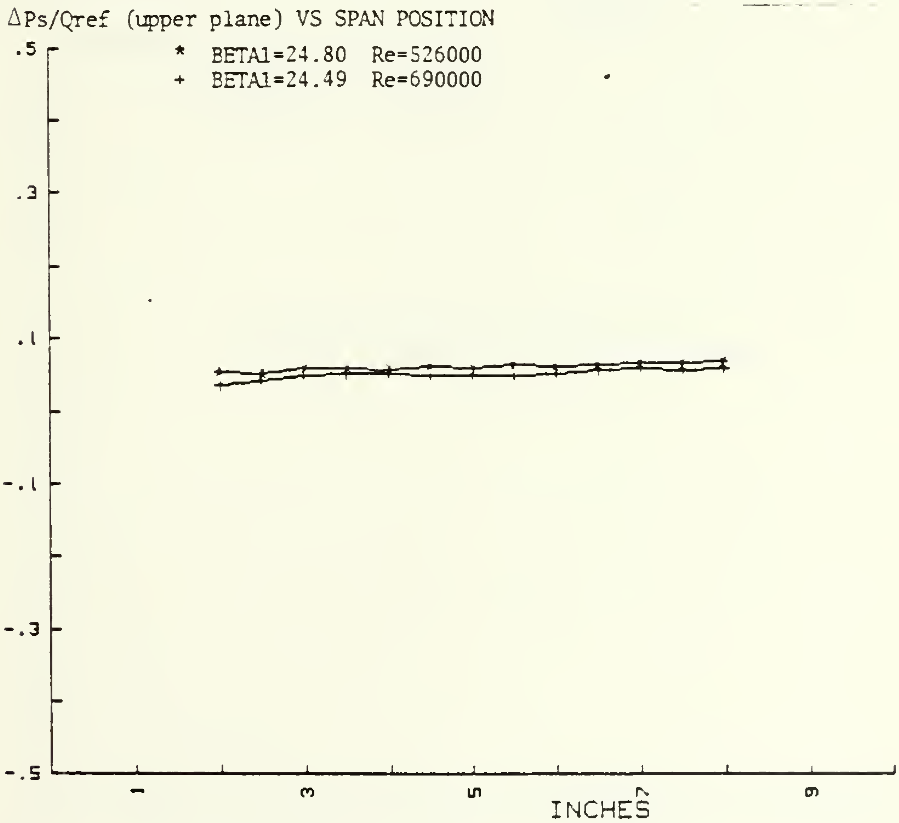


Figure A-2

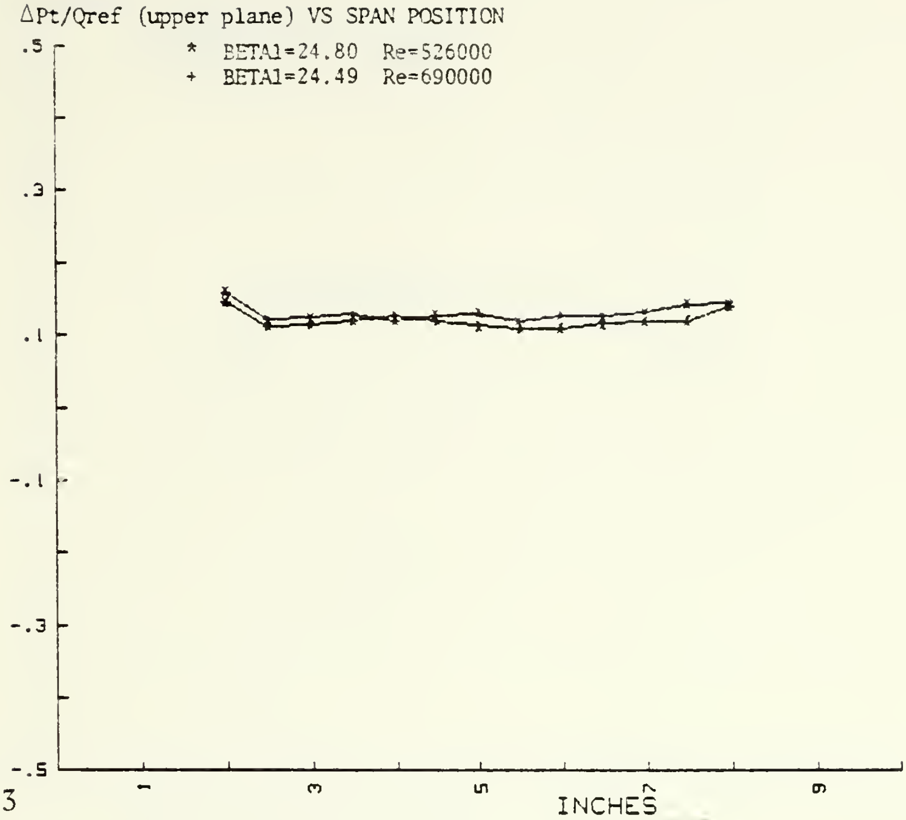


Figure A-3

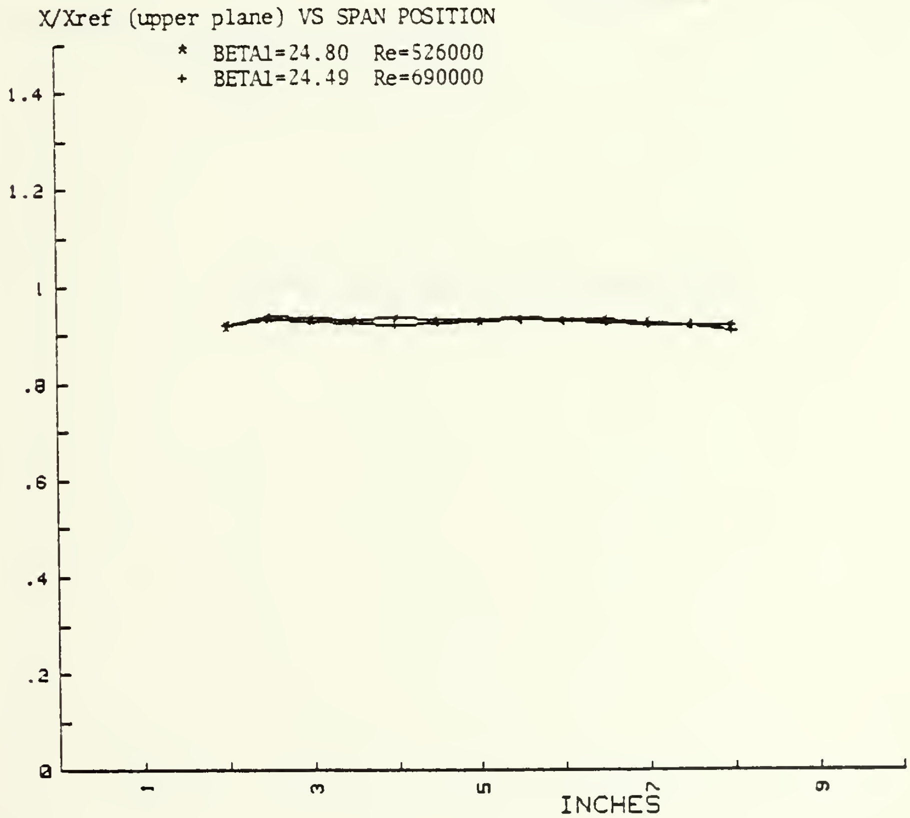


Figure A-4

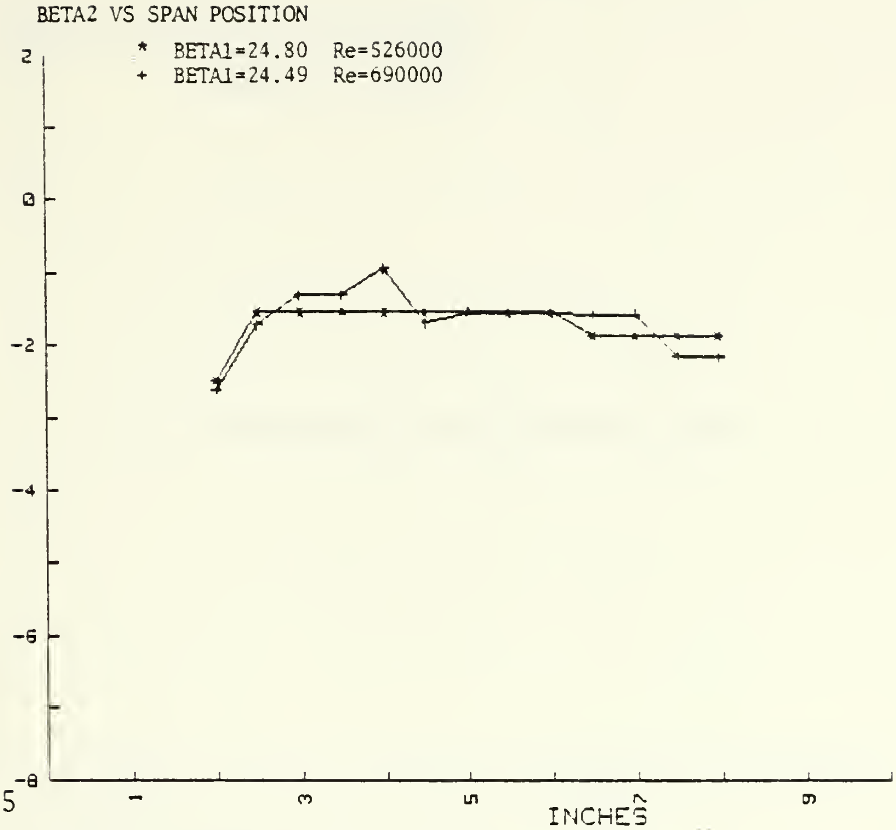


Figure A-5

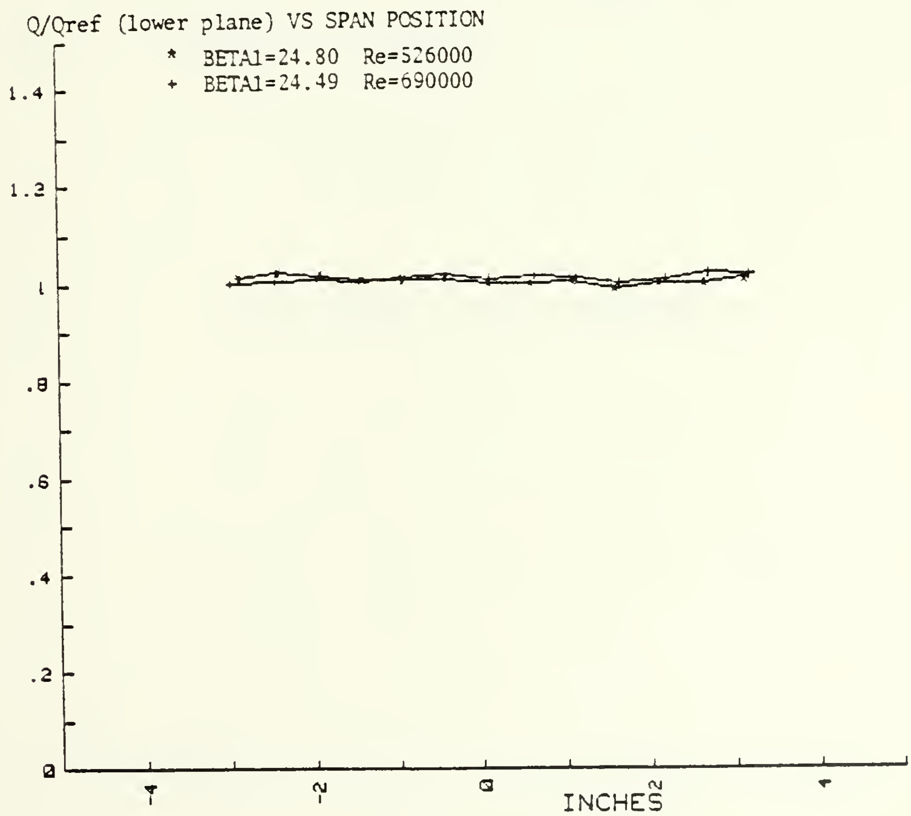


Figure A-6

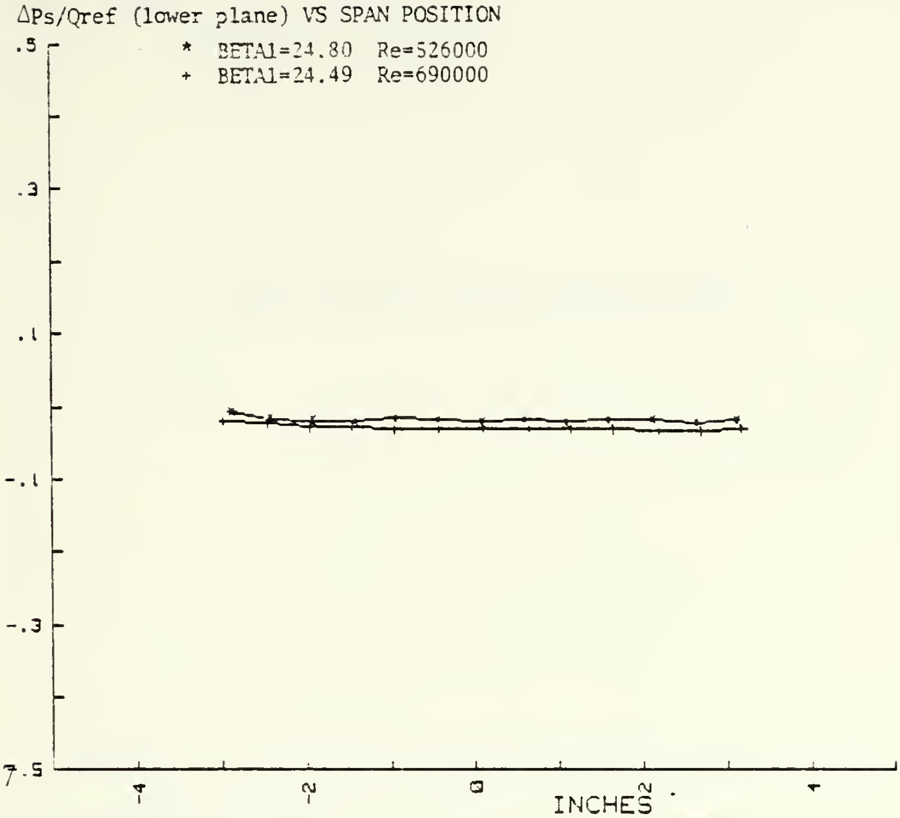


Figure A-7

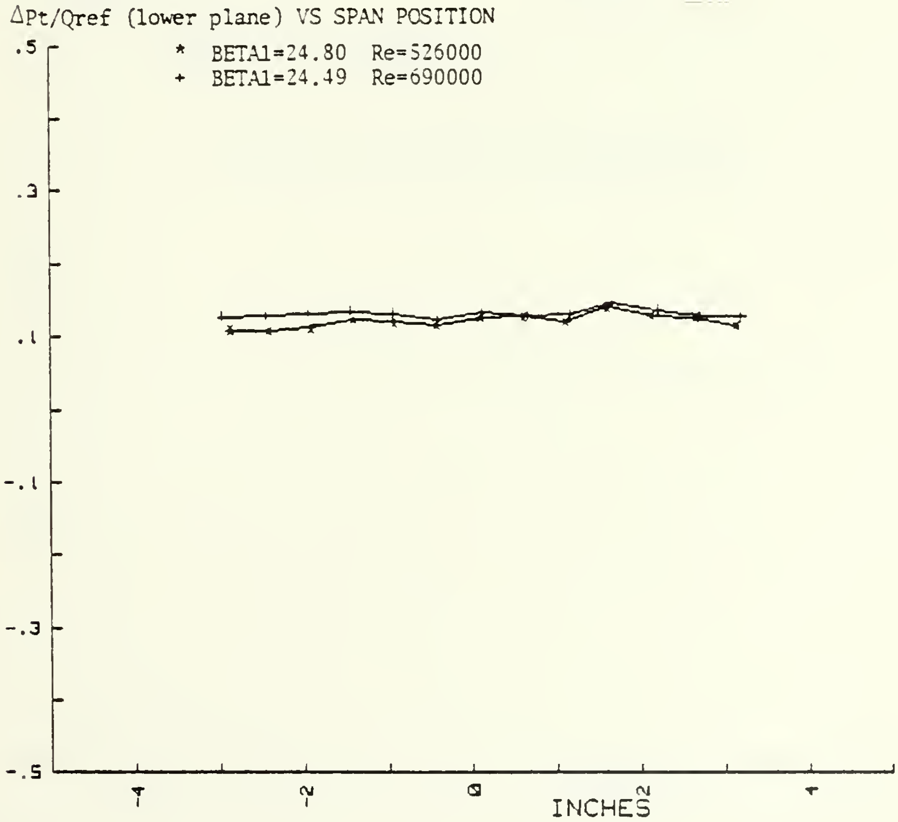


Figure A-8

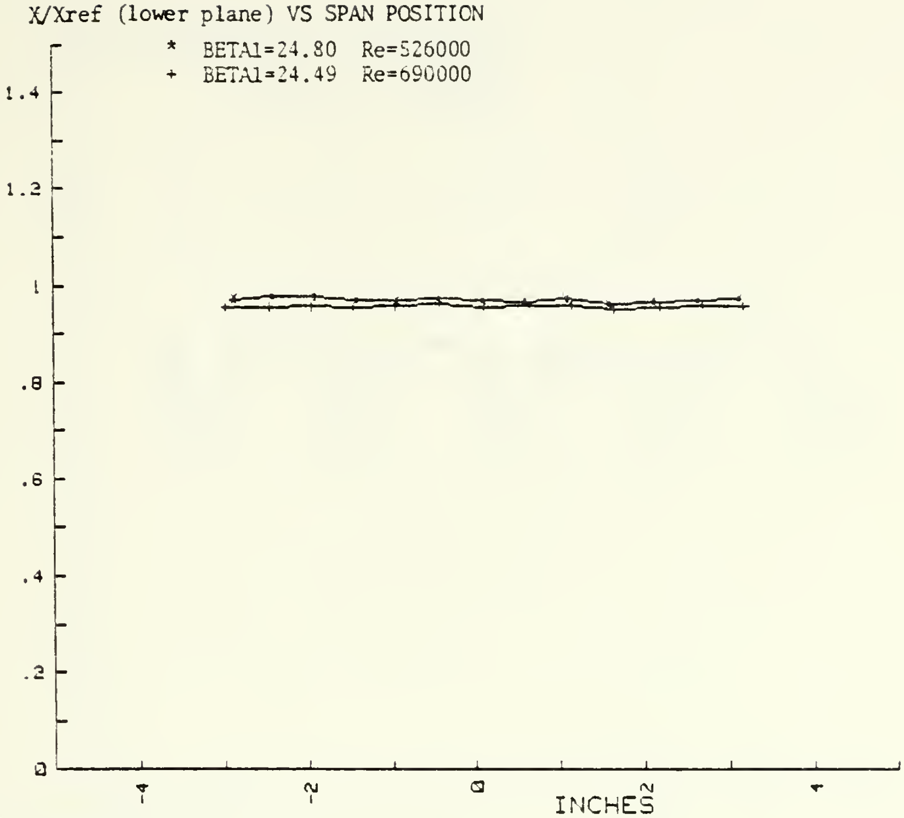


Figure A-9

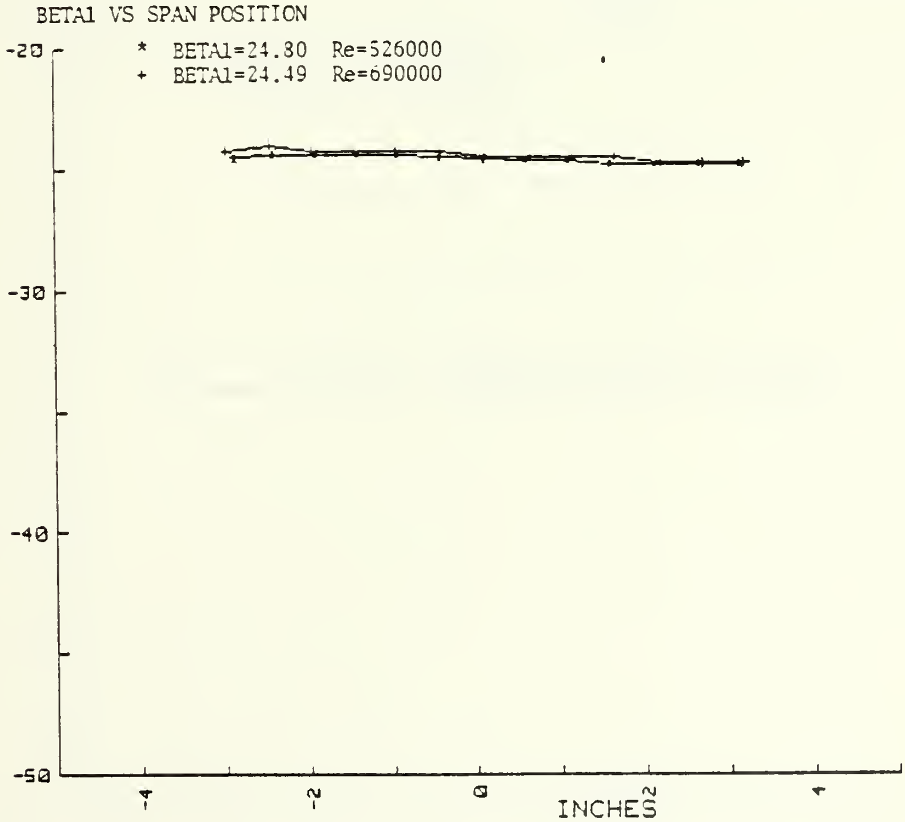


Figure A-10

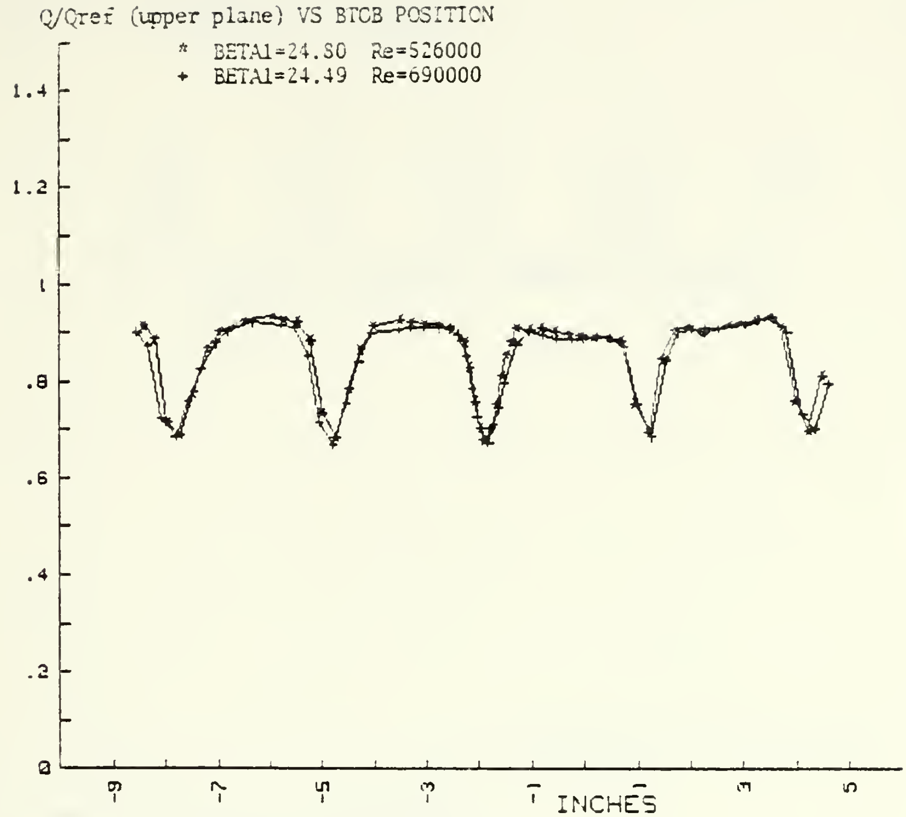


Figure A-11

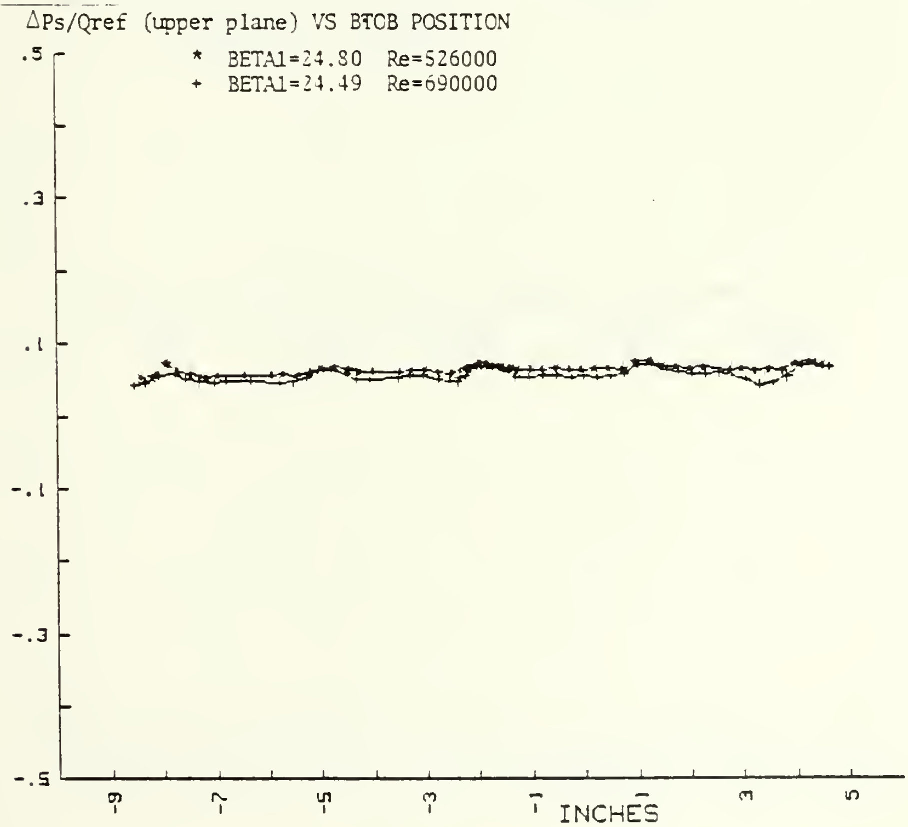


Figure A-12

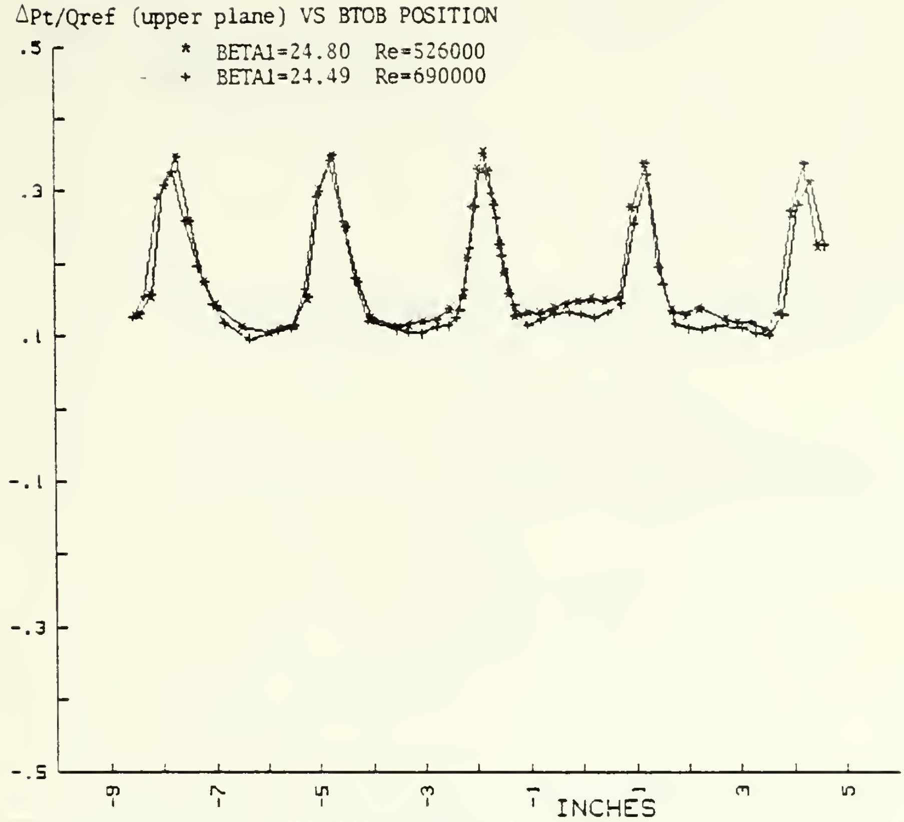


Figure A-13

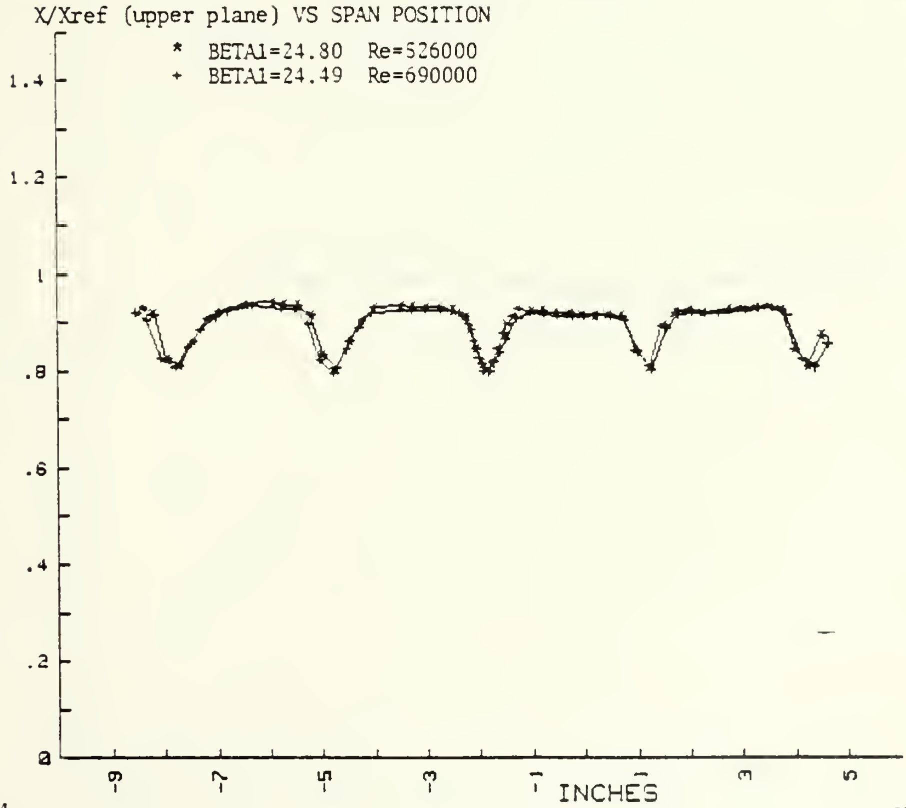


Figure A-14

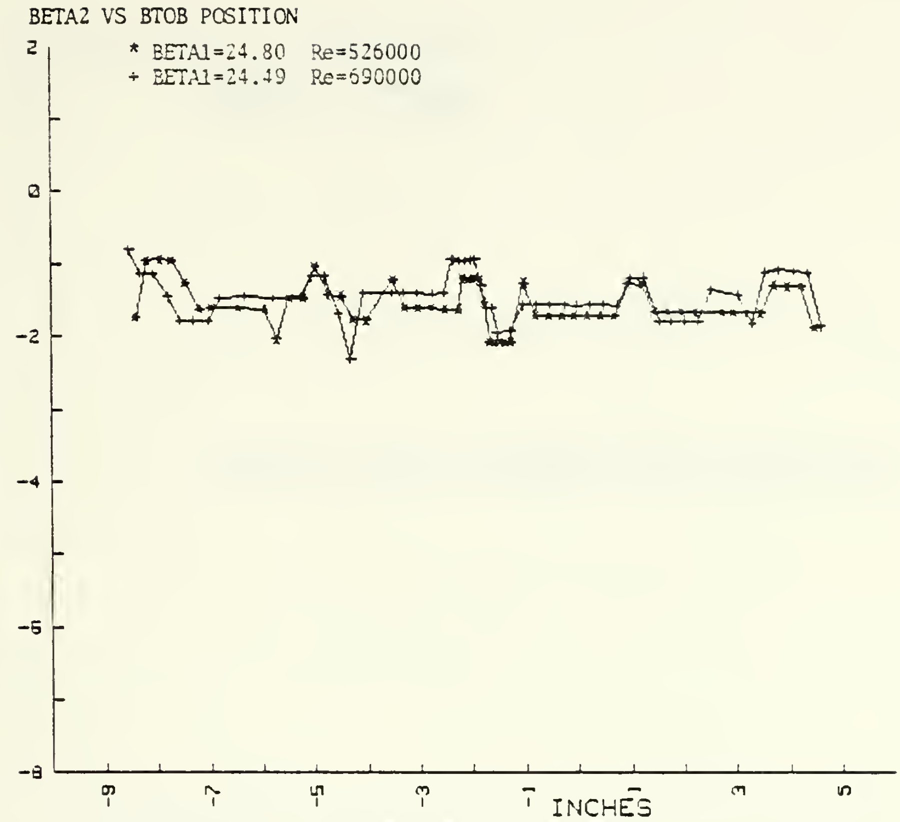


Figure A-15

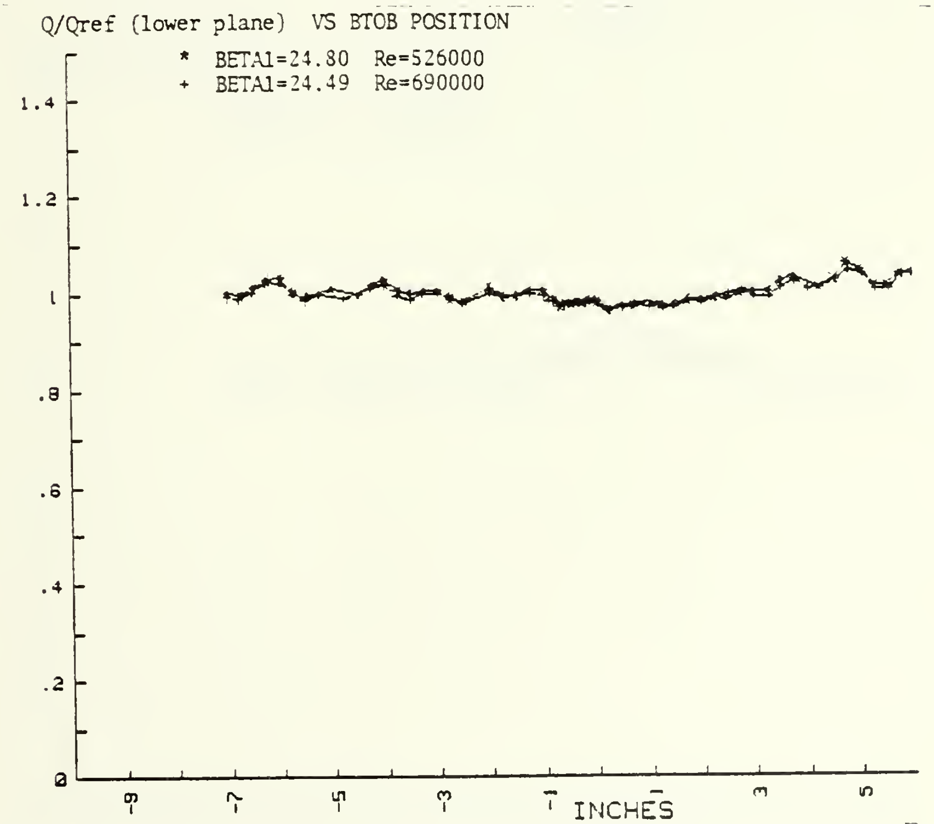


Figure A-16

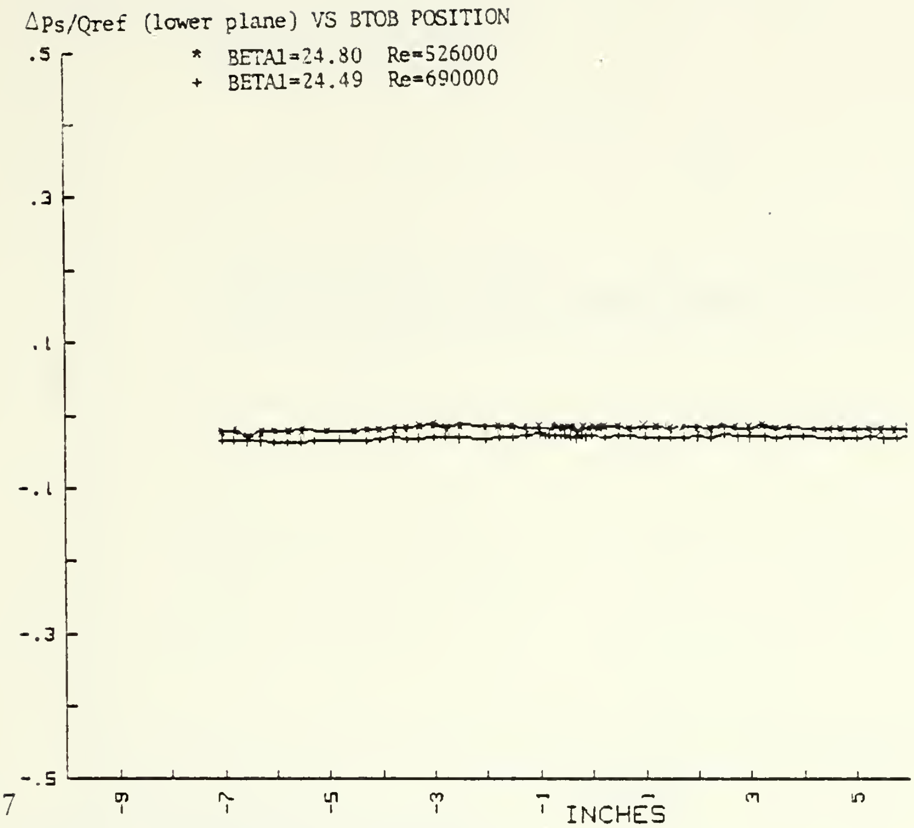


Figure A-17

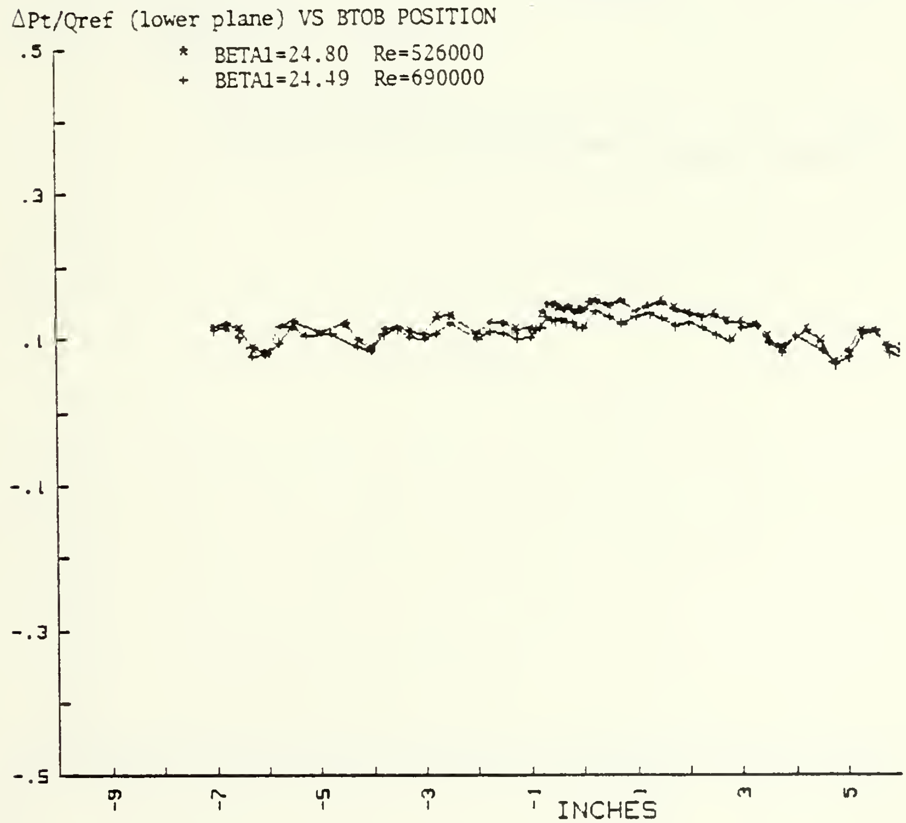
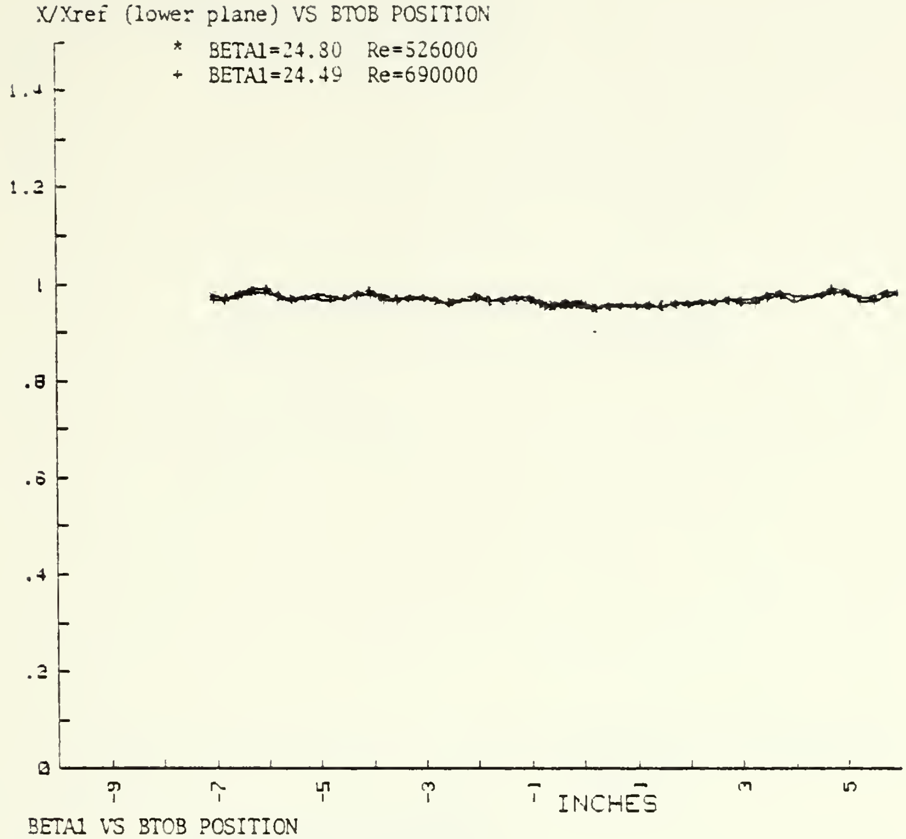


Figure A-18



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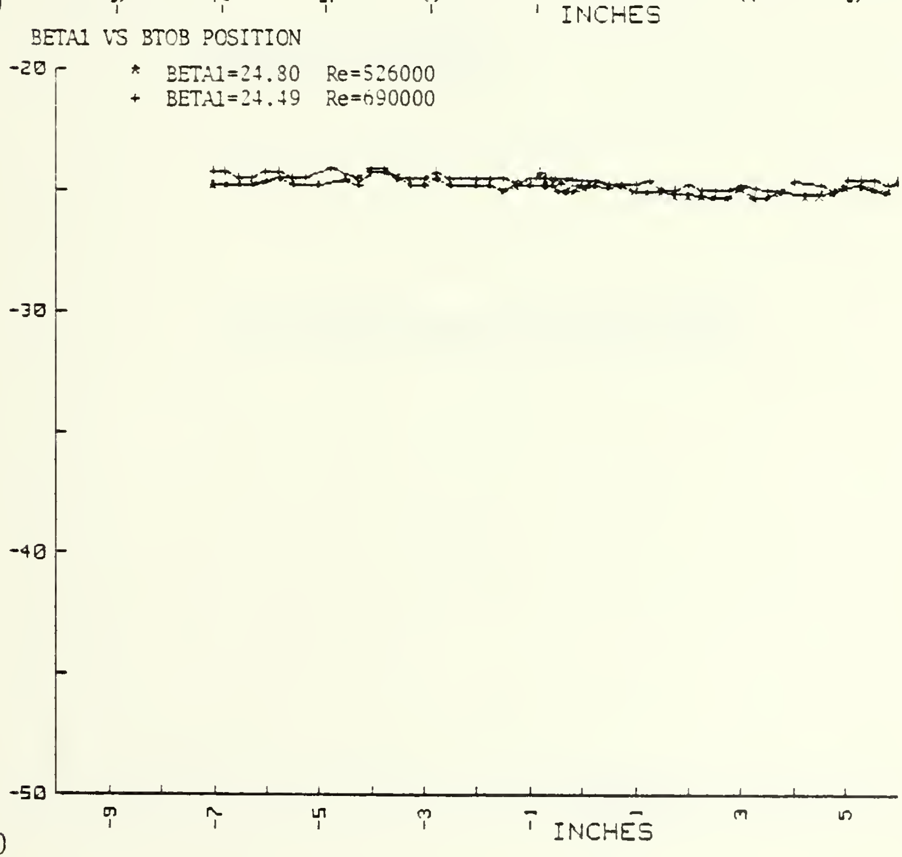

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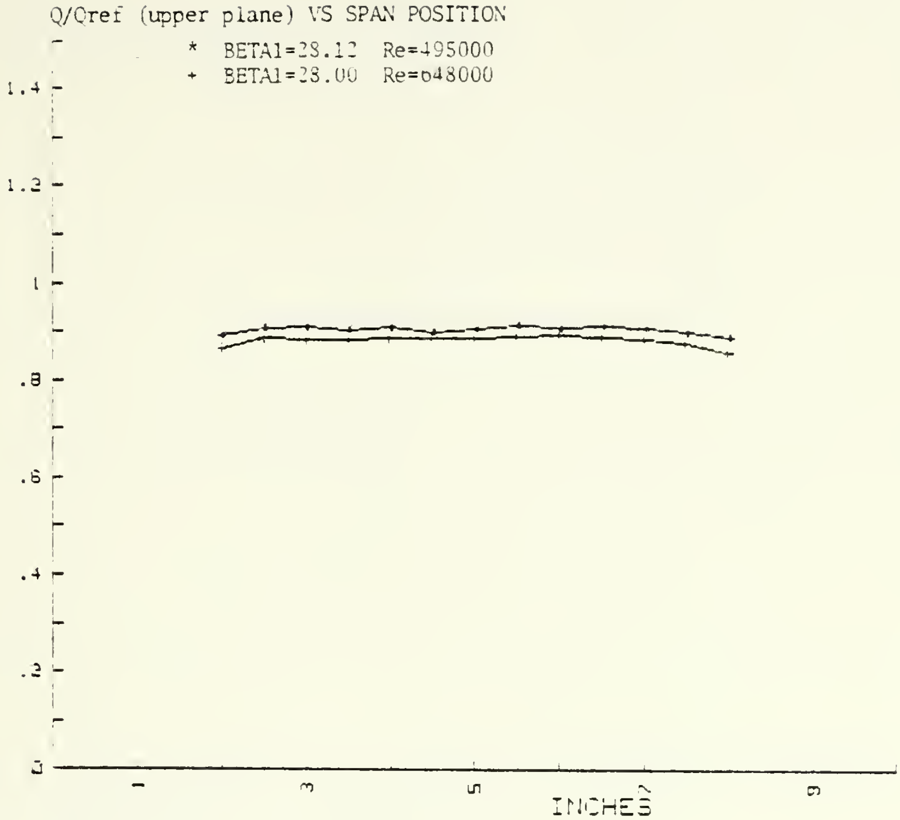

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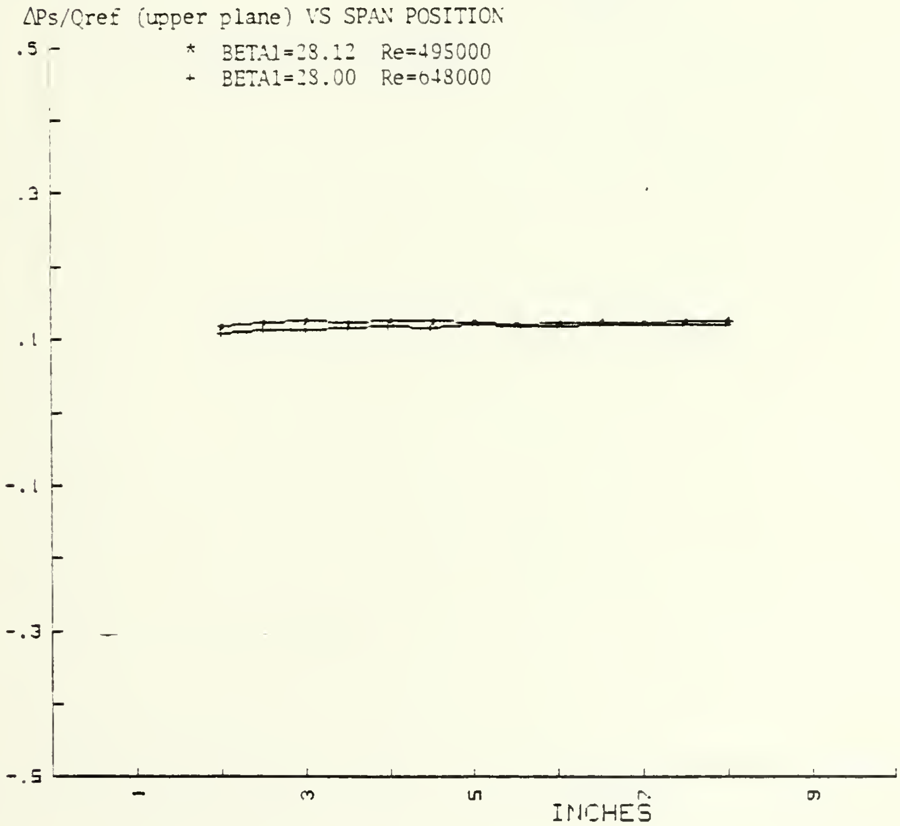

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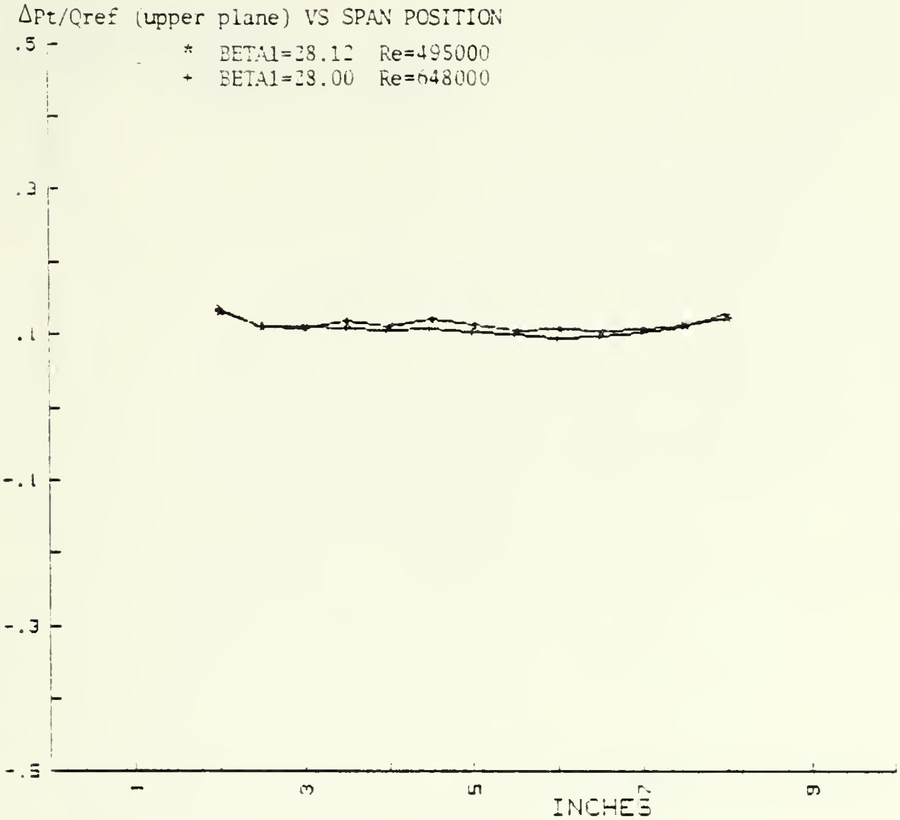

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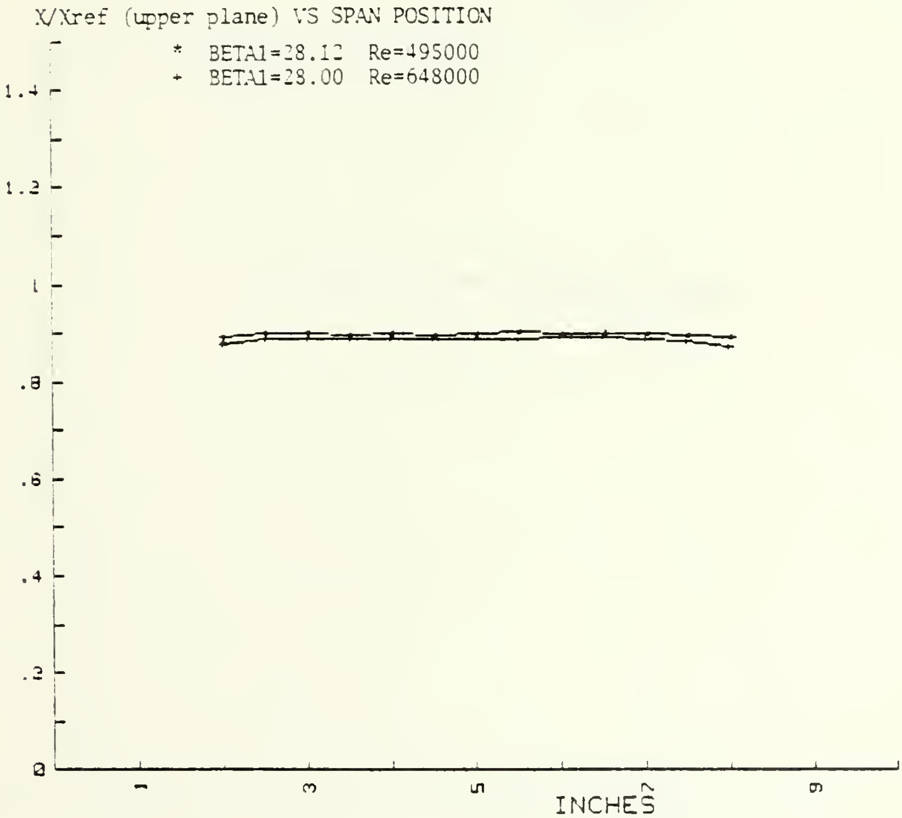

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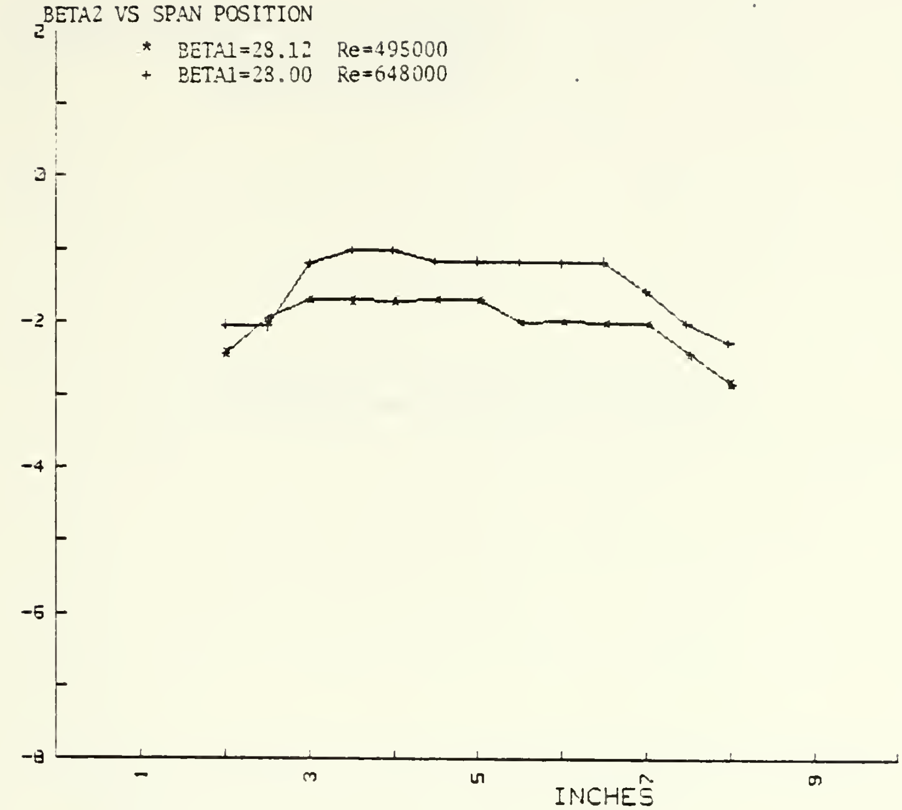

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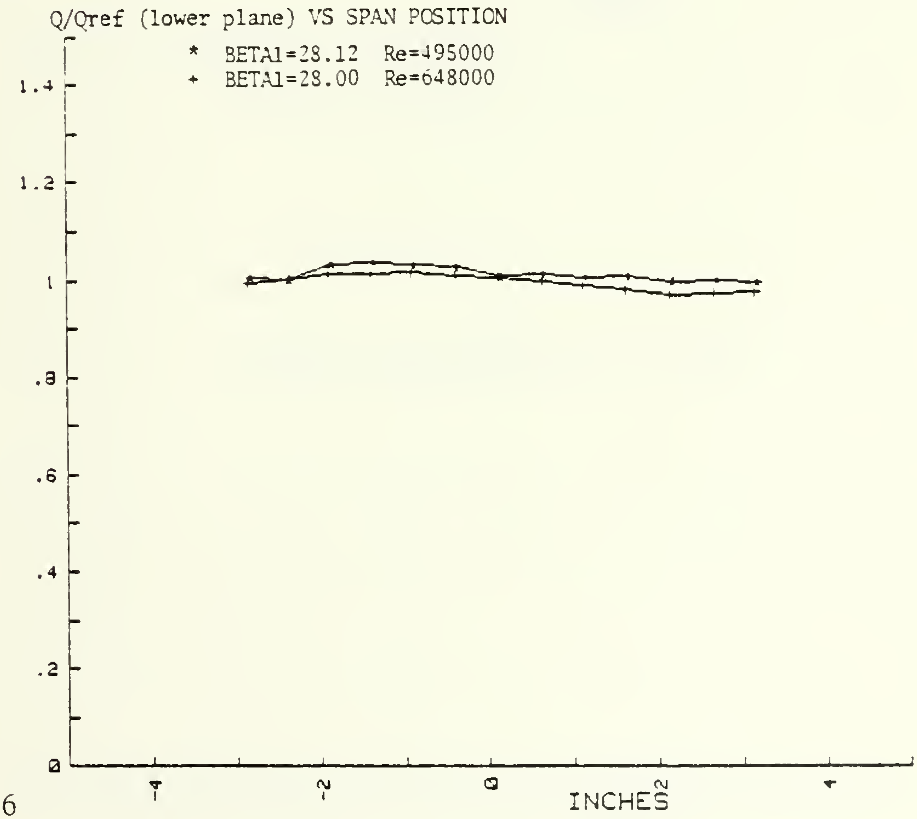

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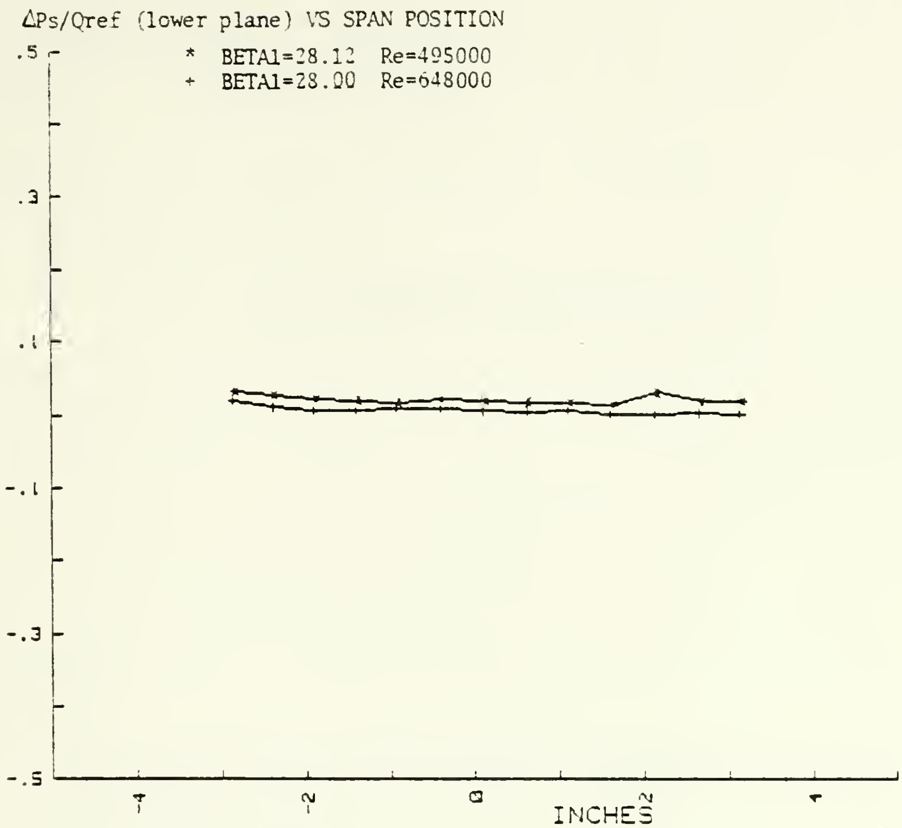

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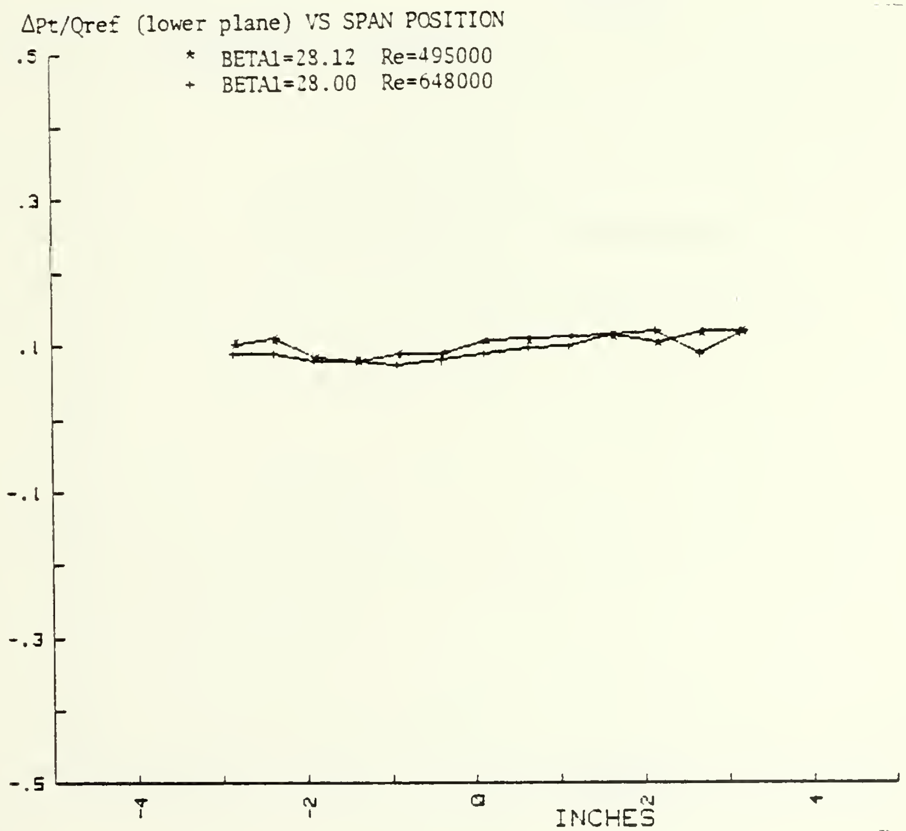

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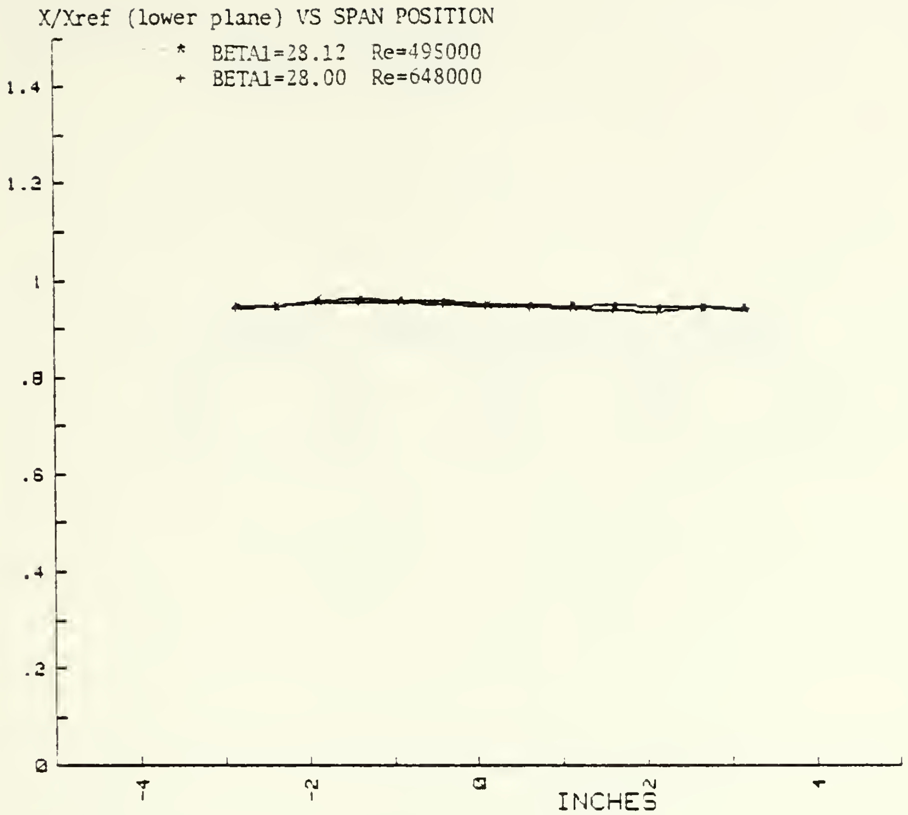

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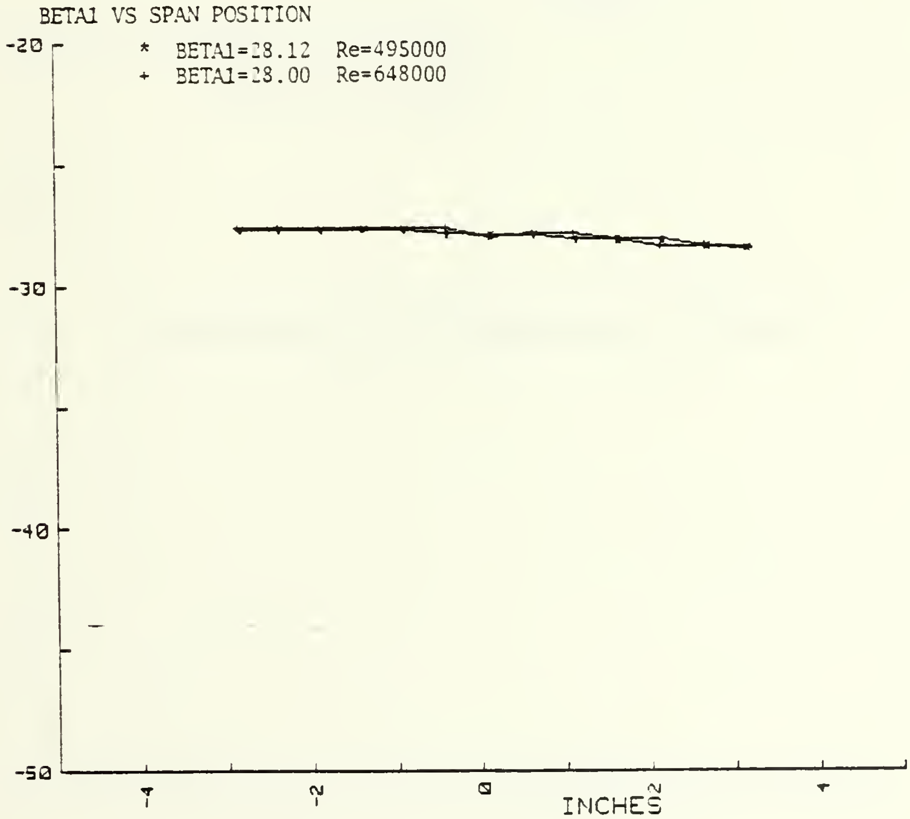

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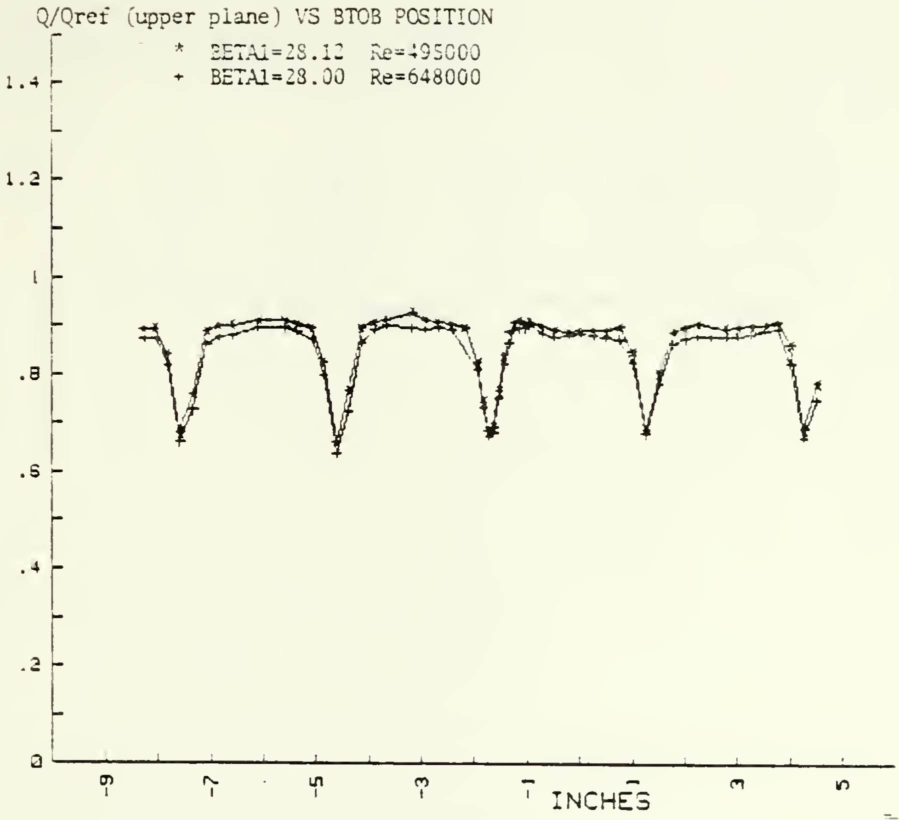

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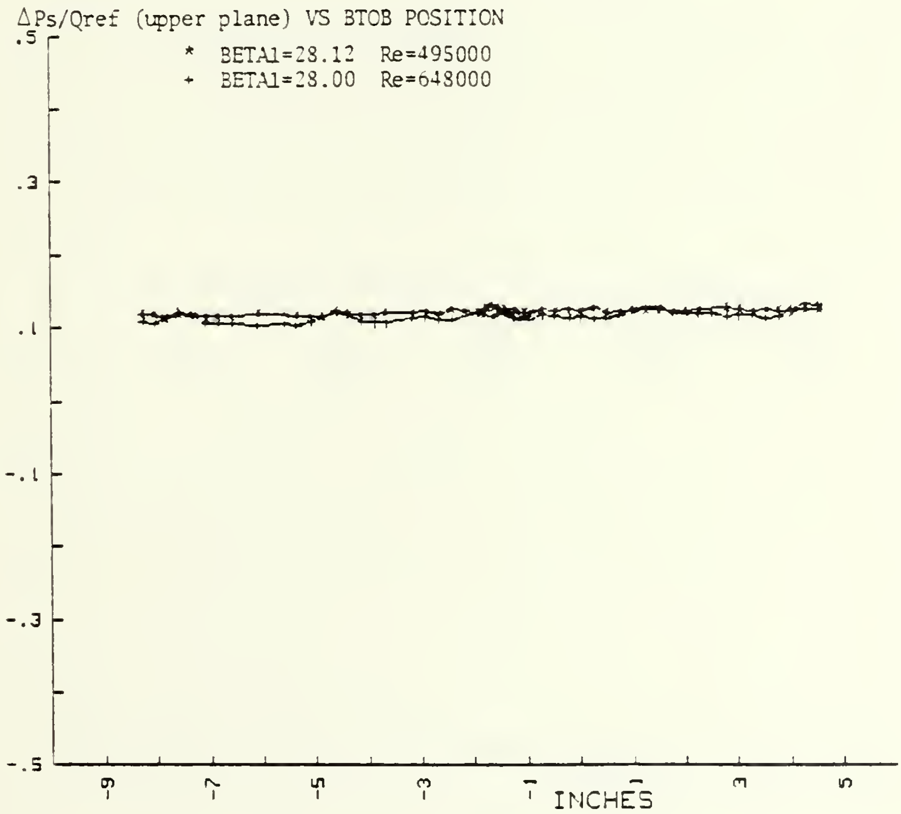

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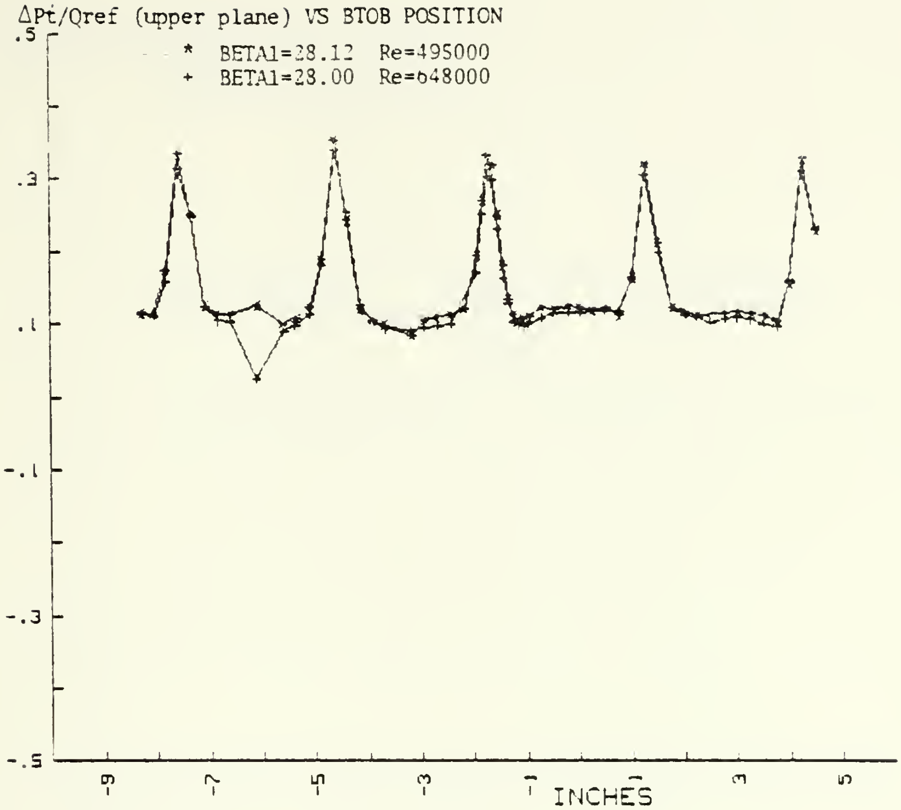

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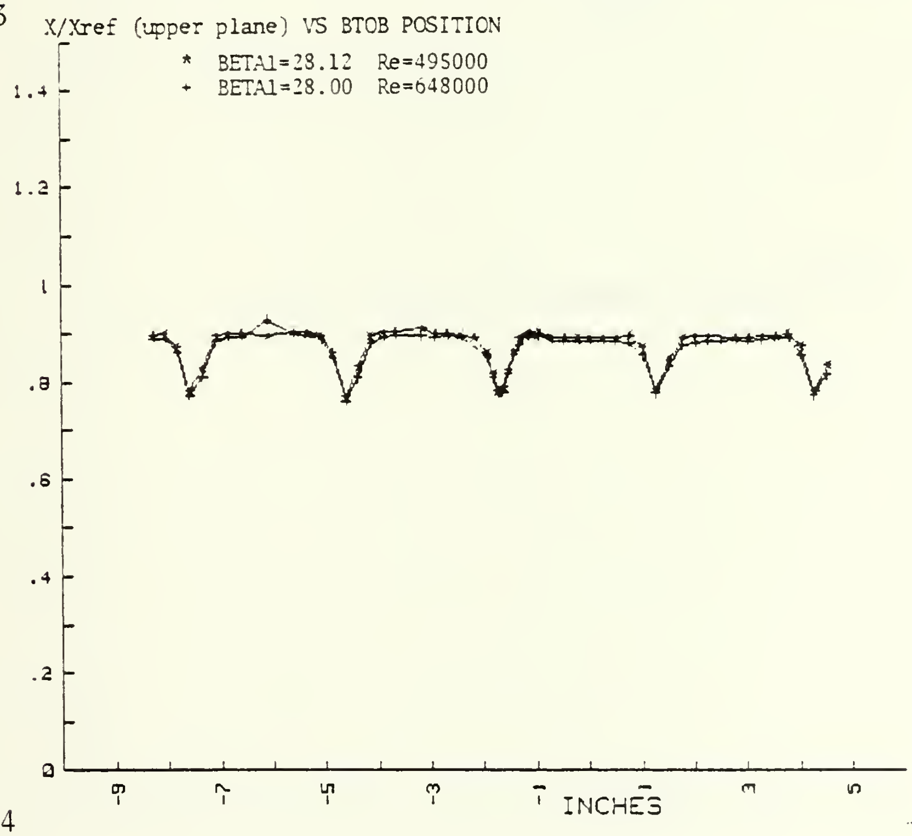

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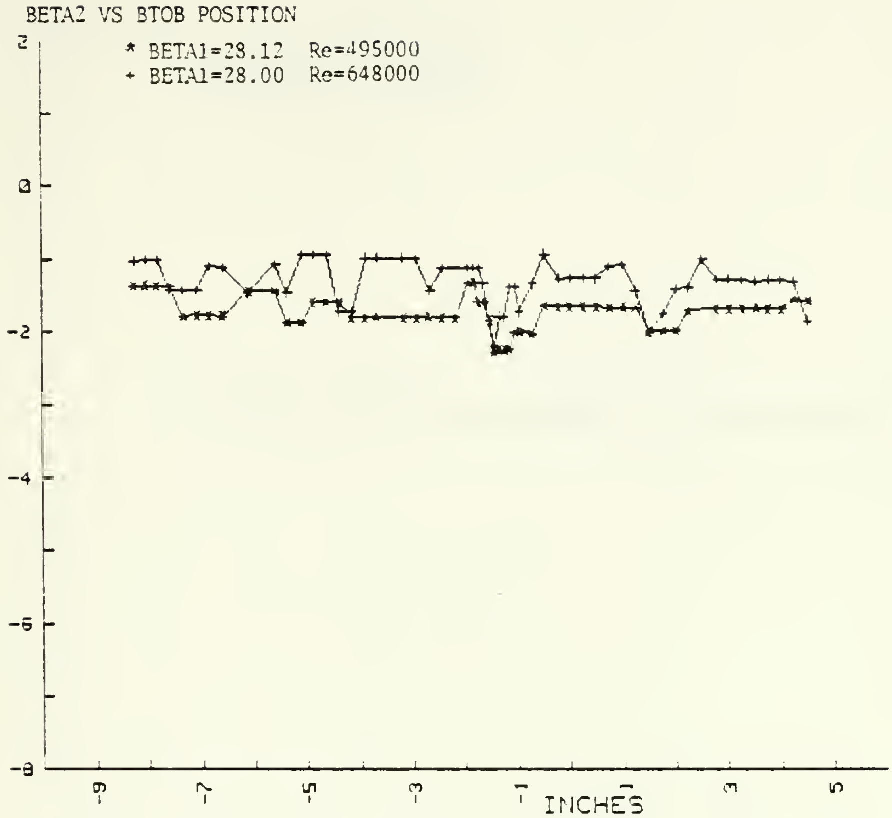

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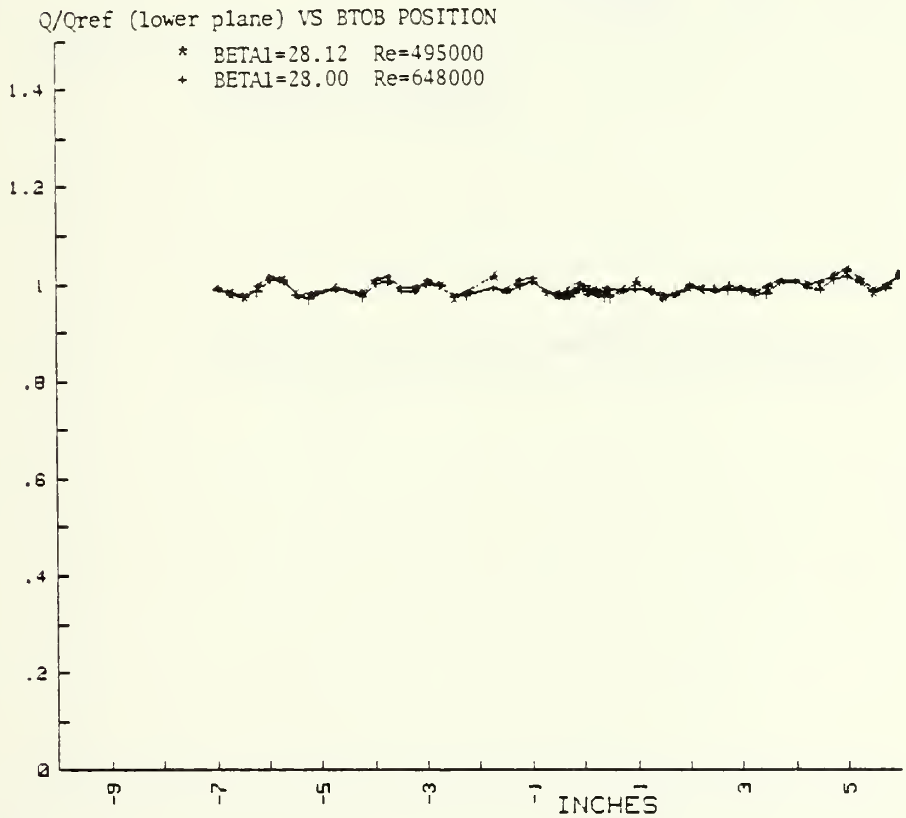

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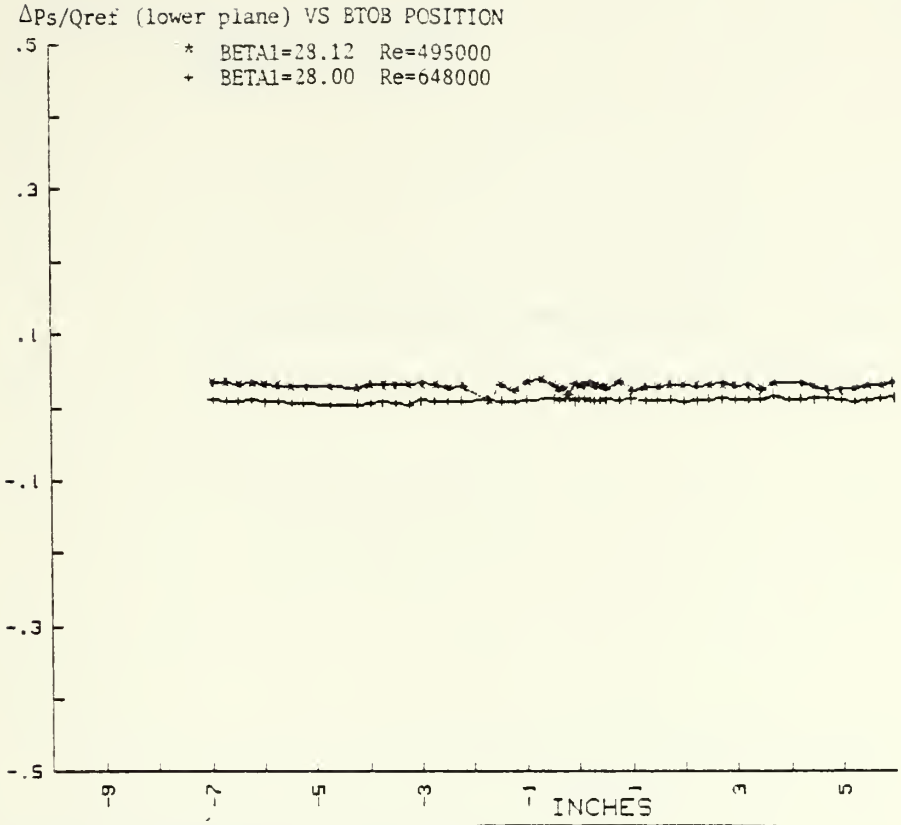

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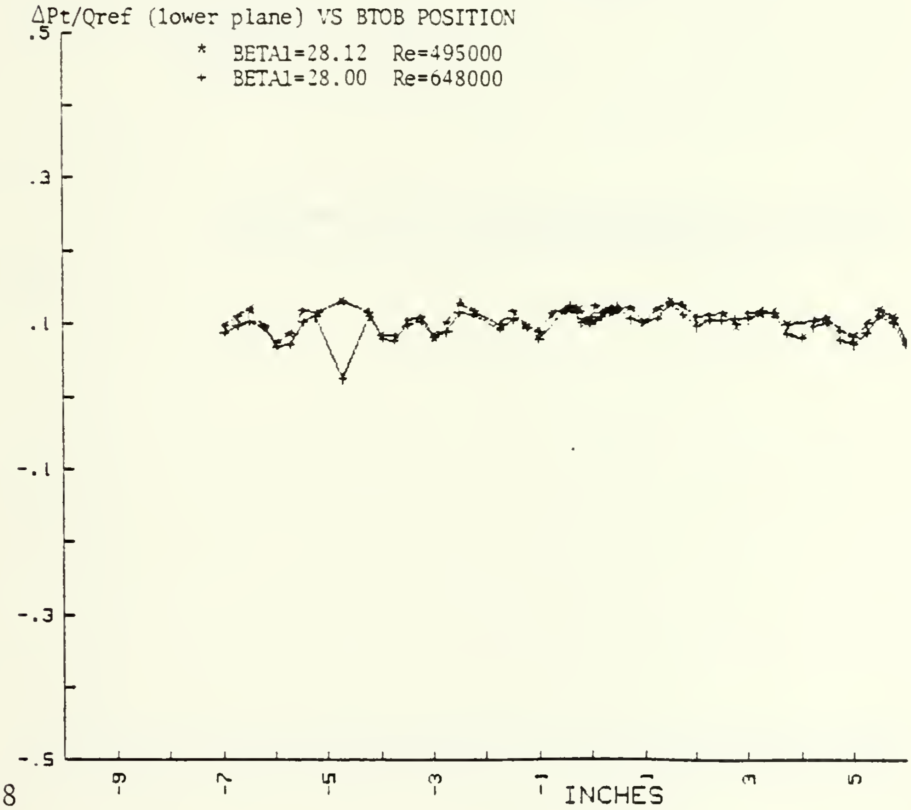

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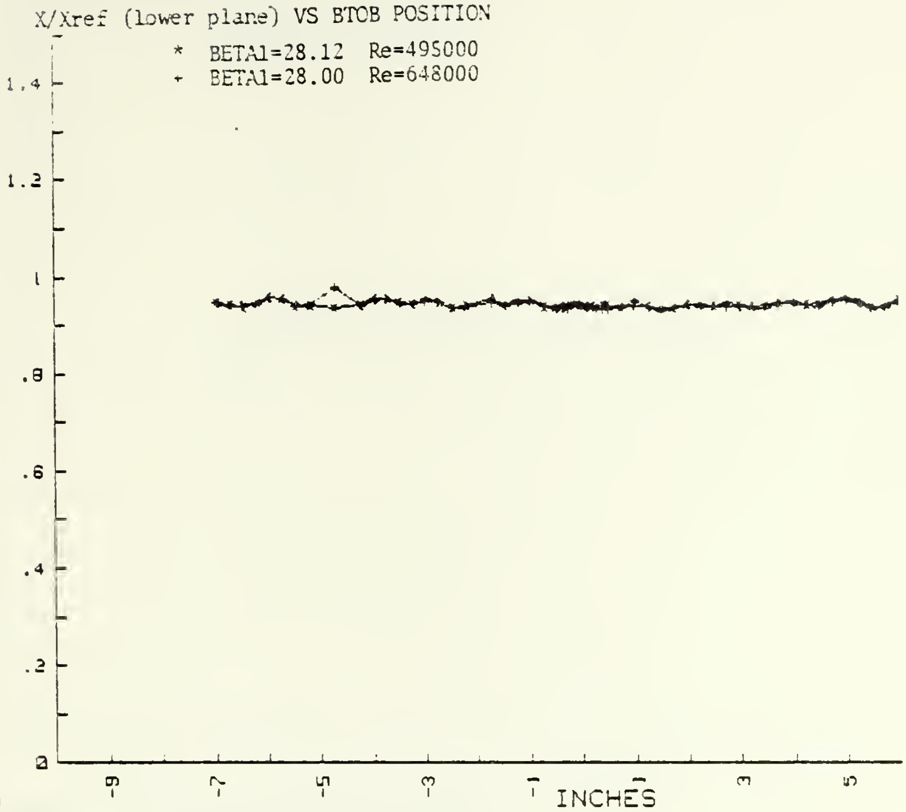

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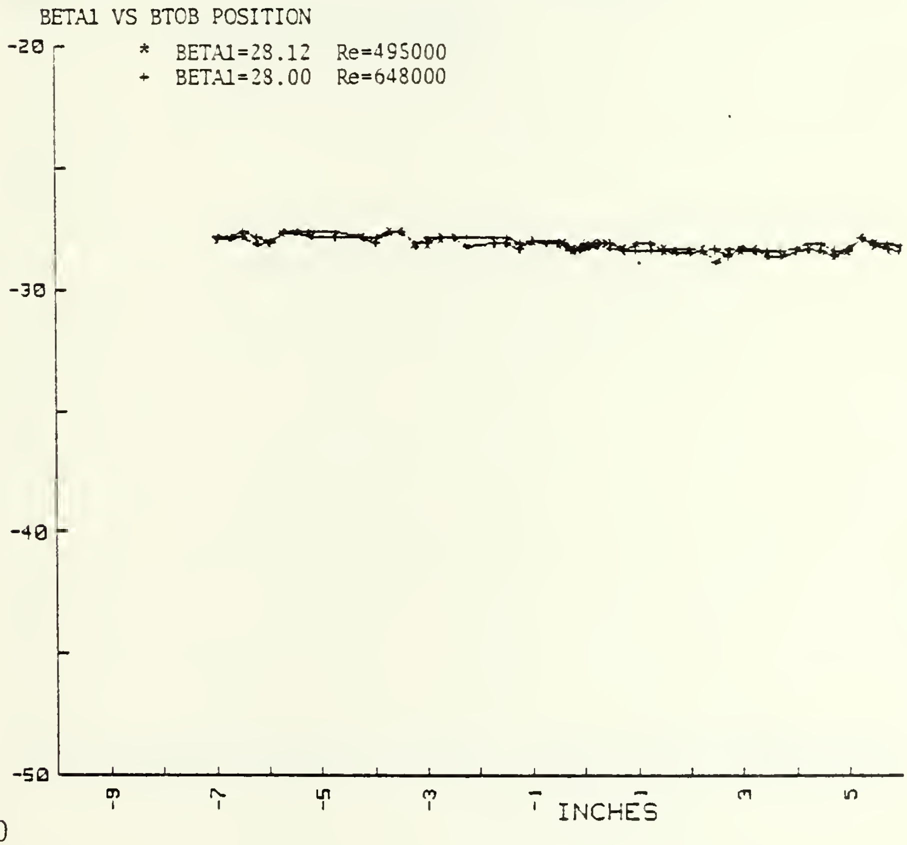

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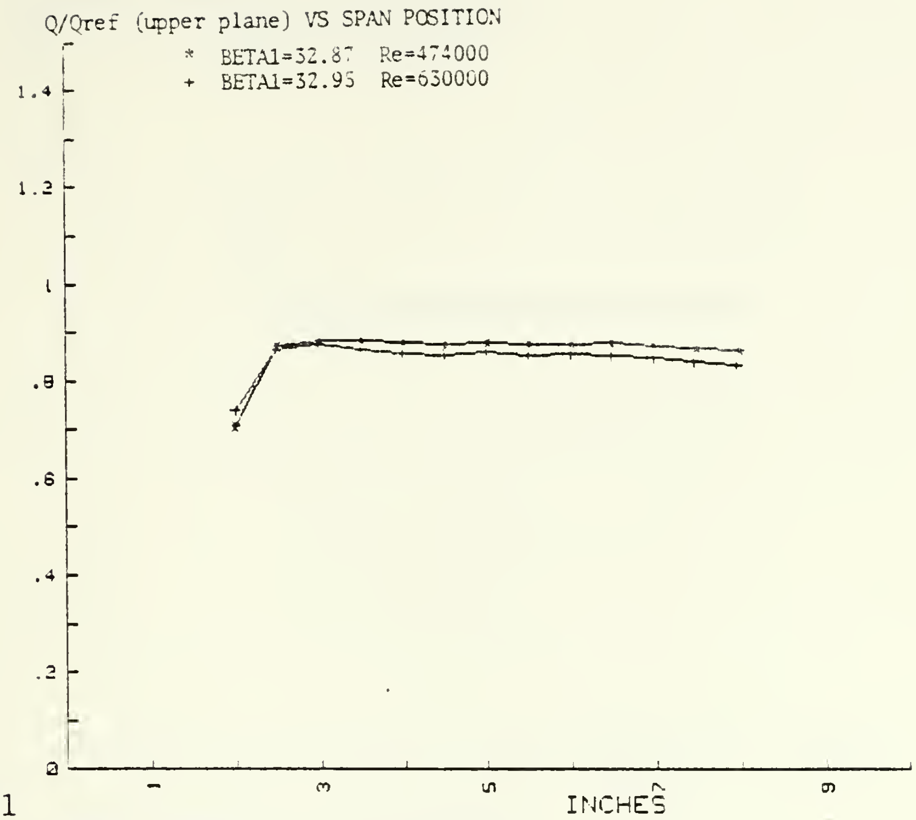

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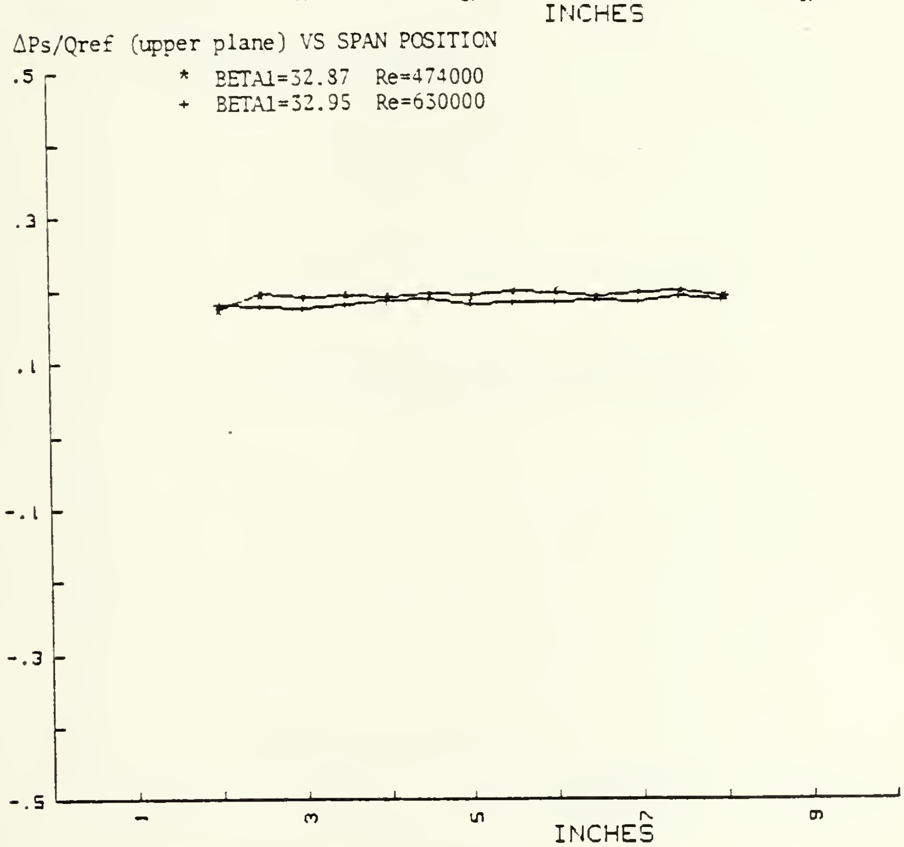

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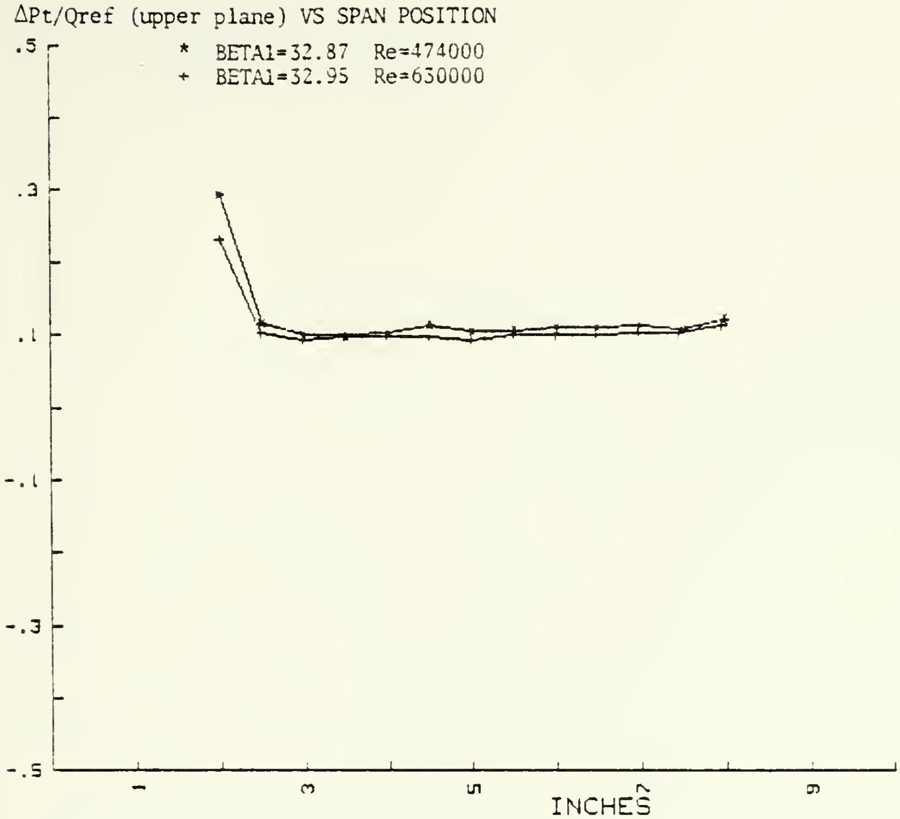

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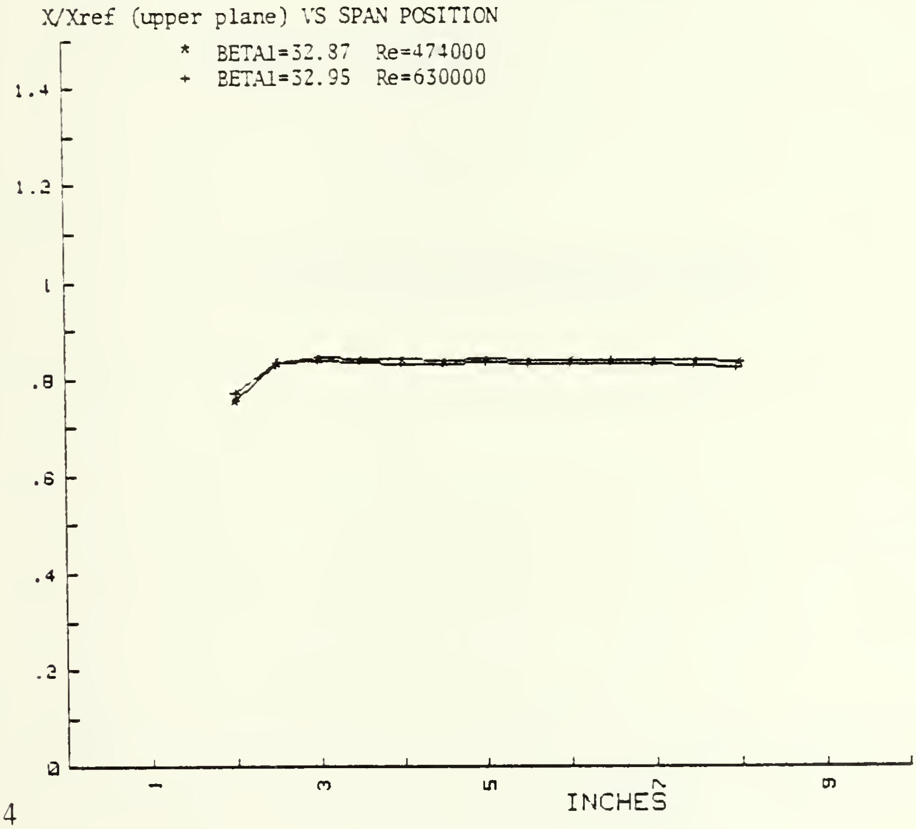

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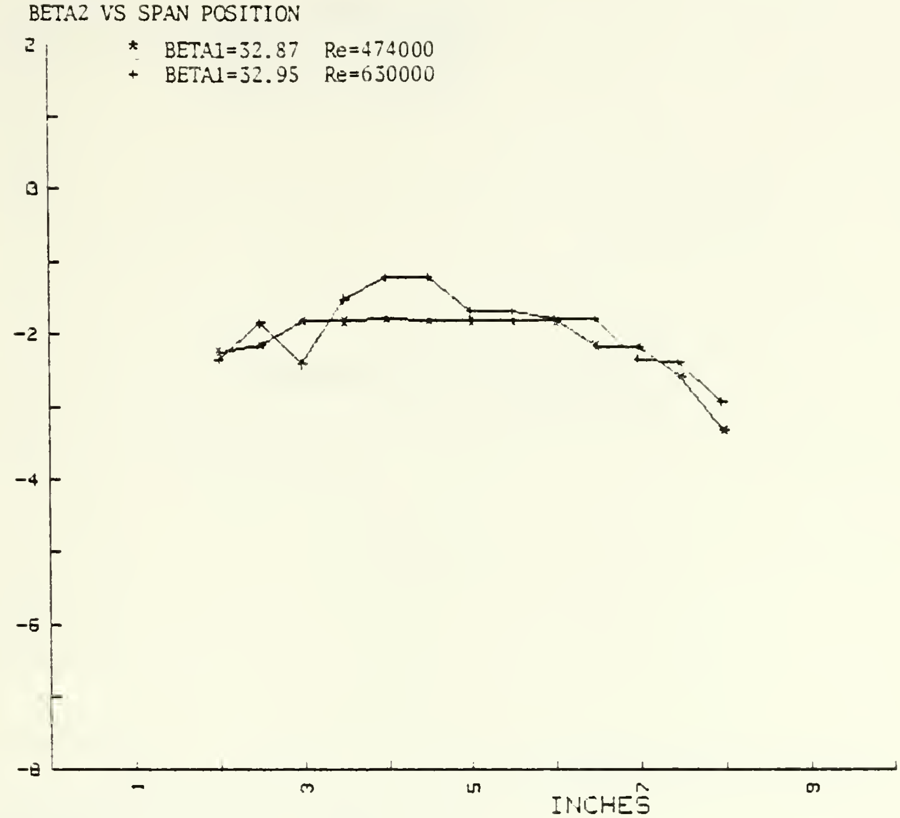

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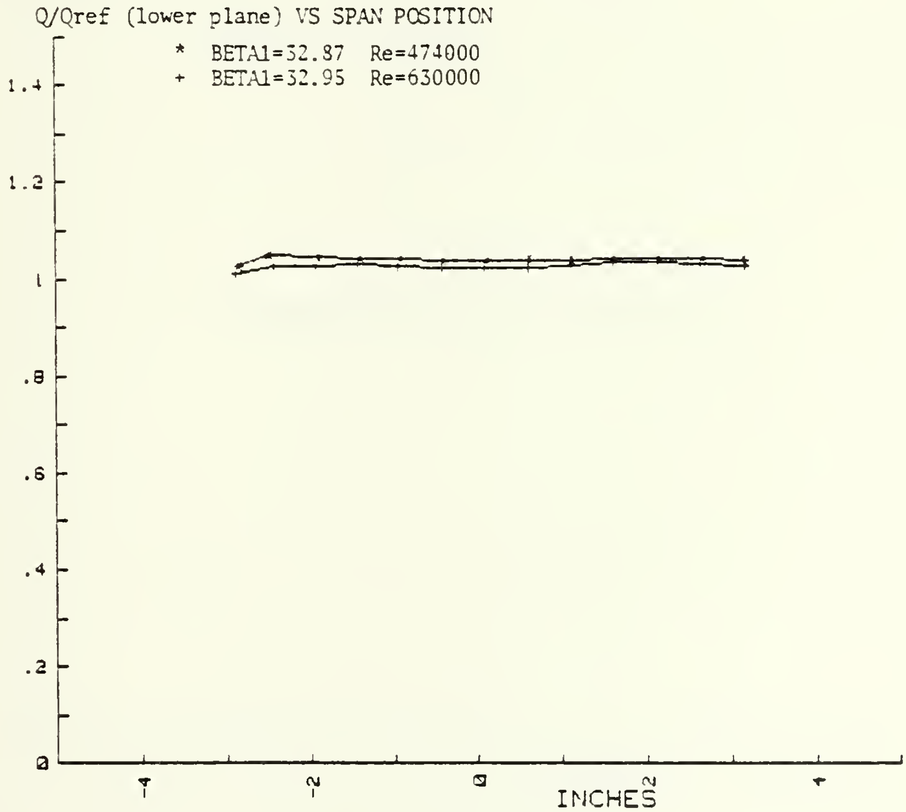

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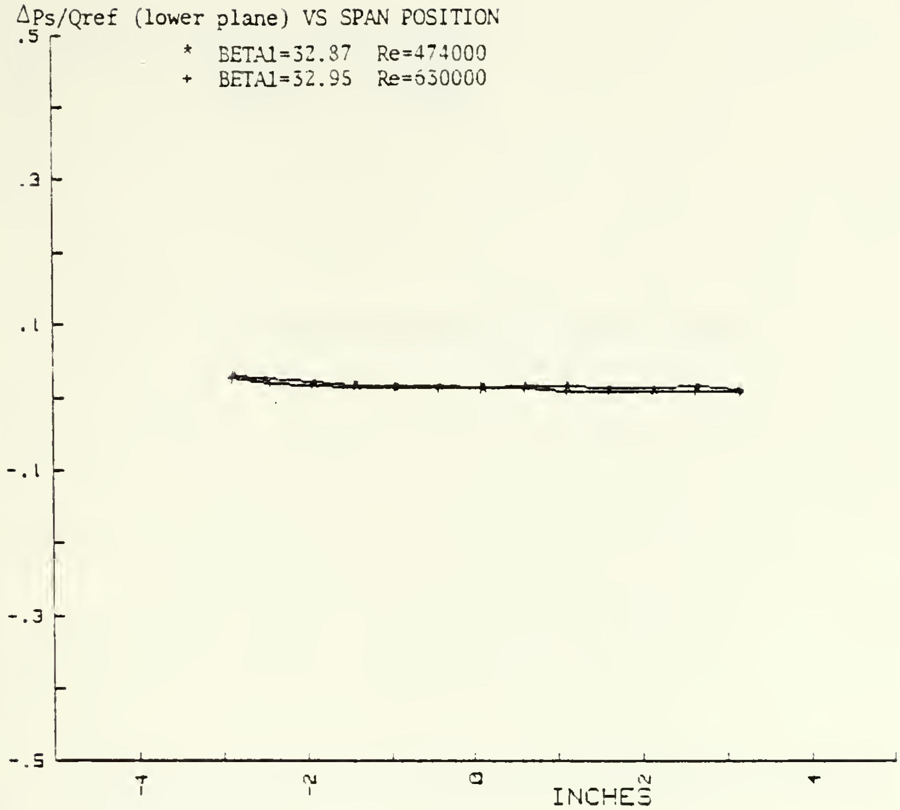

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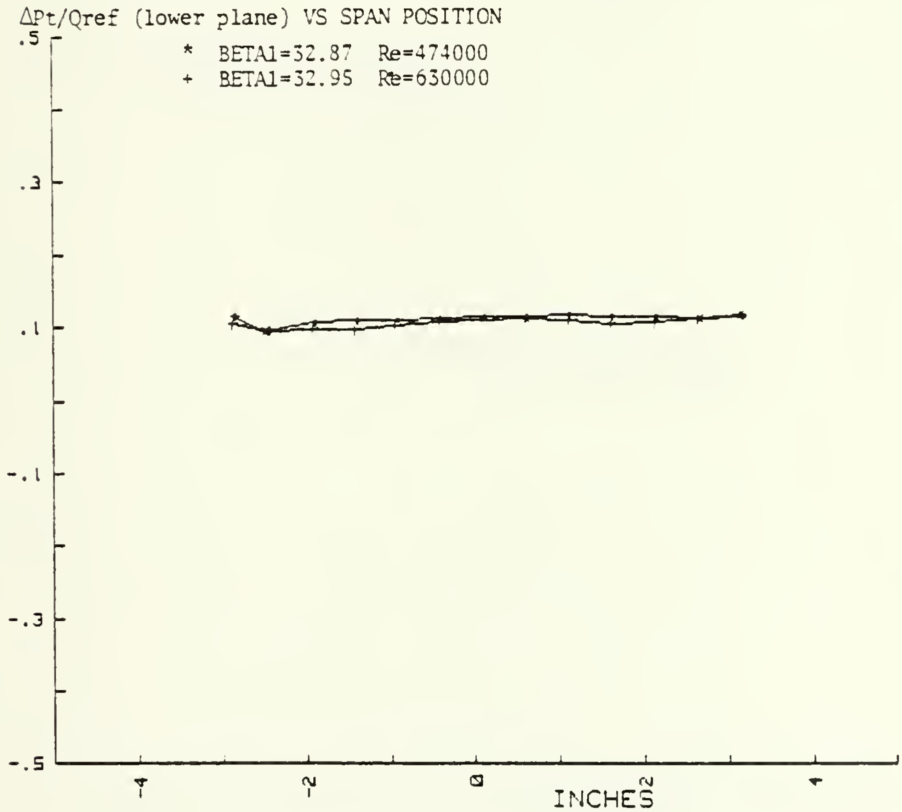

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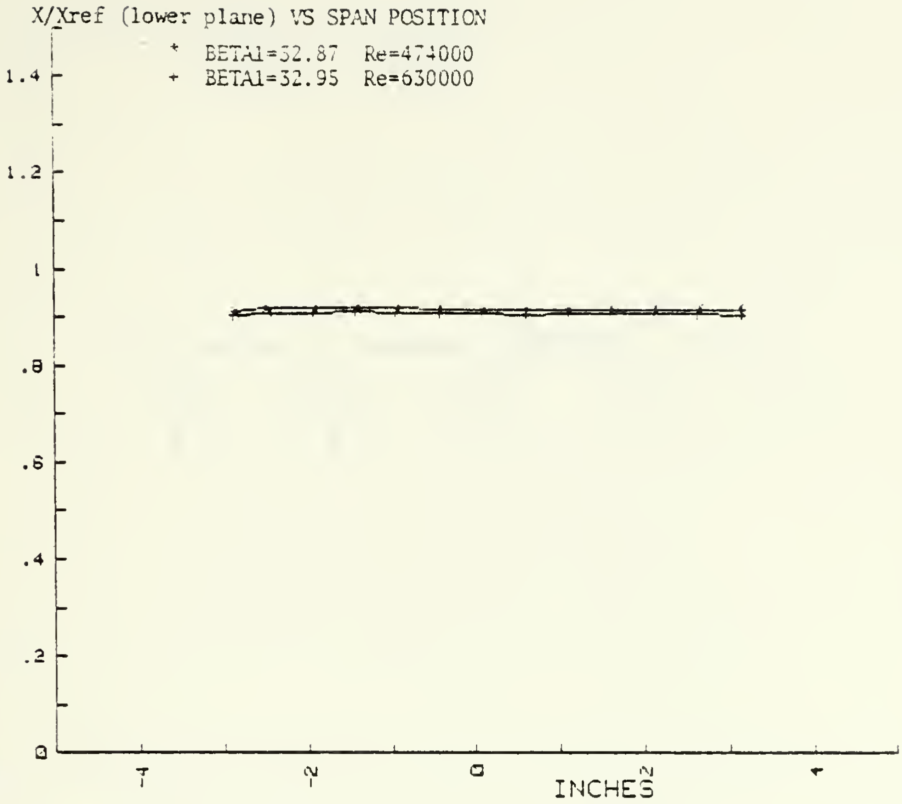

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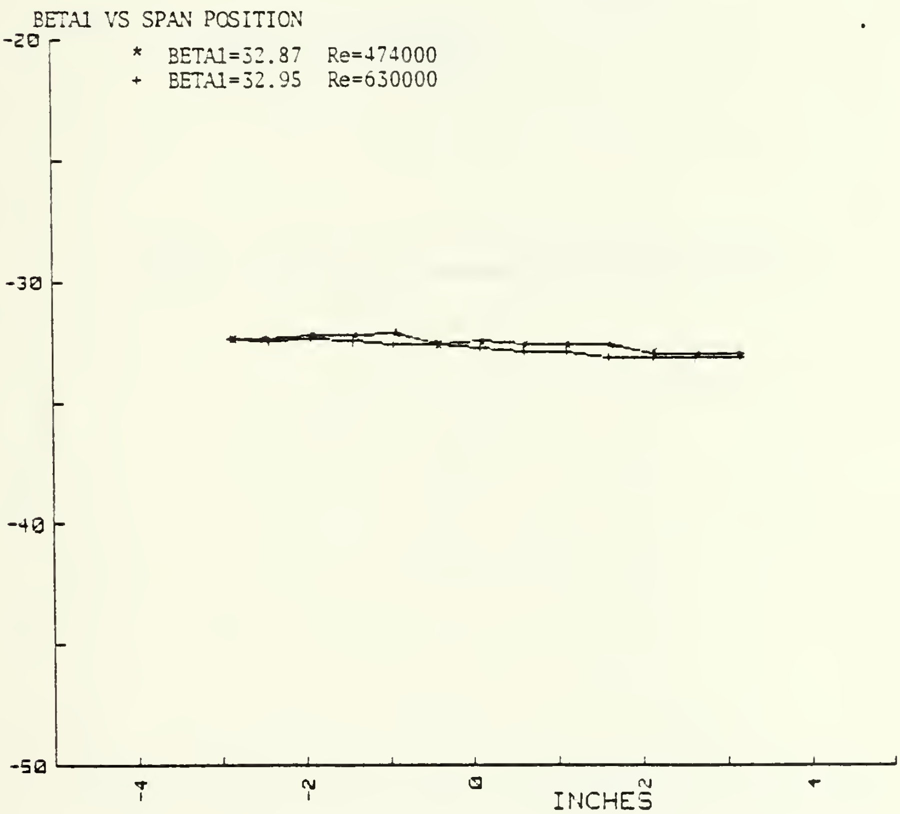

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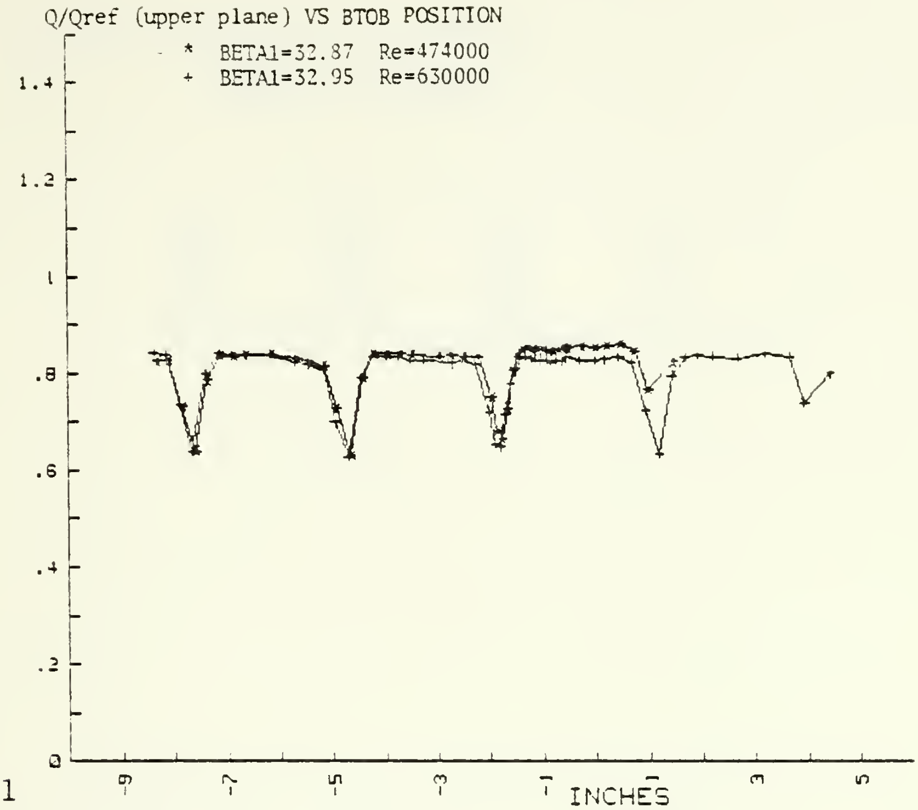

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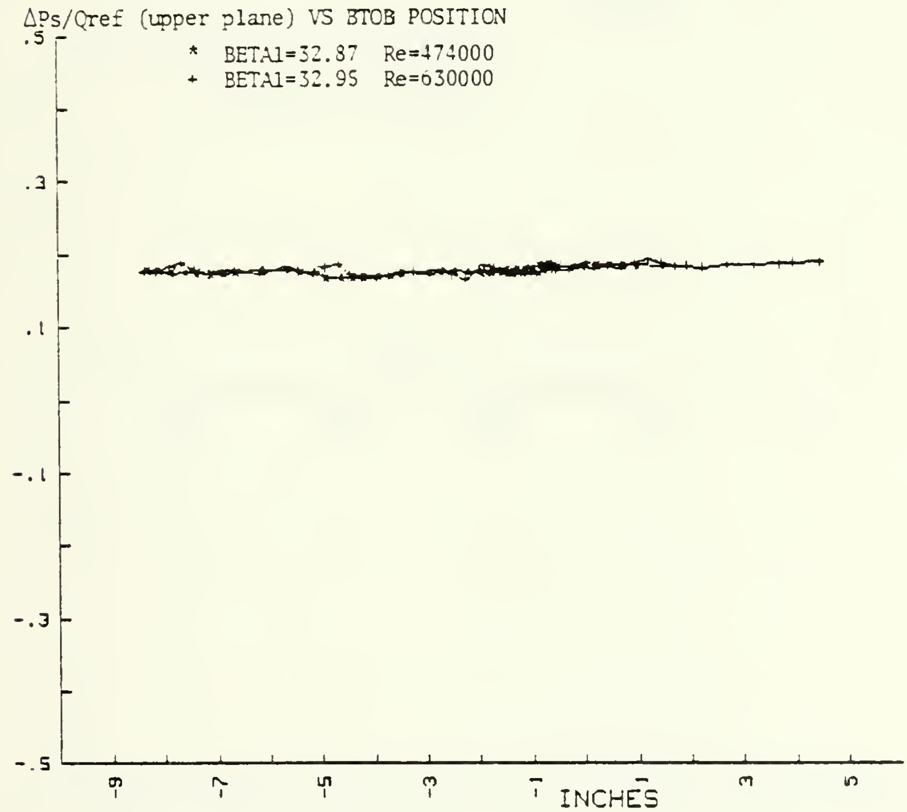

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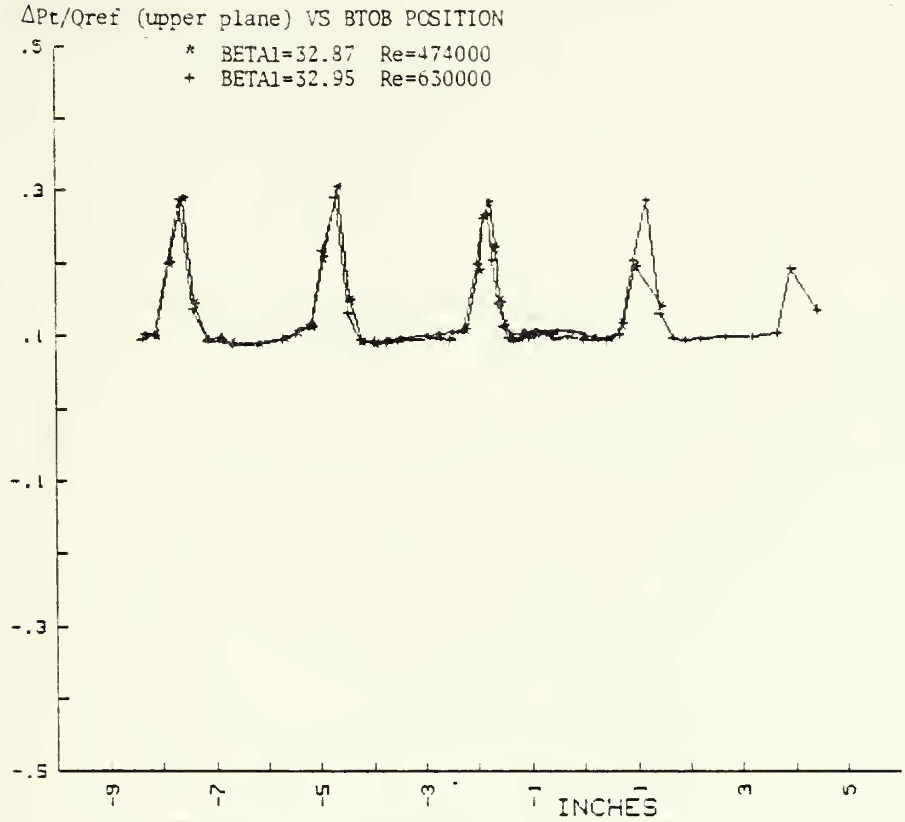

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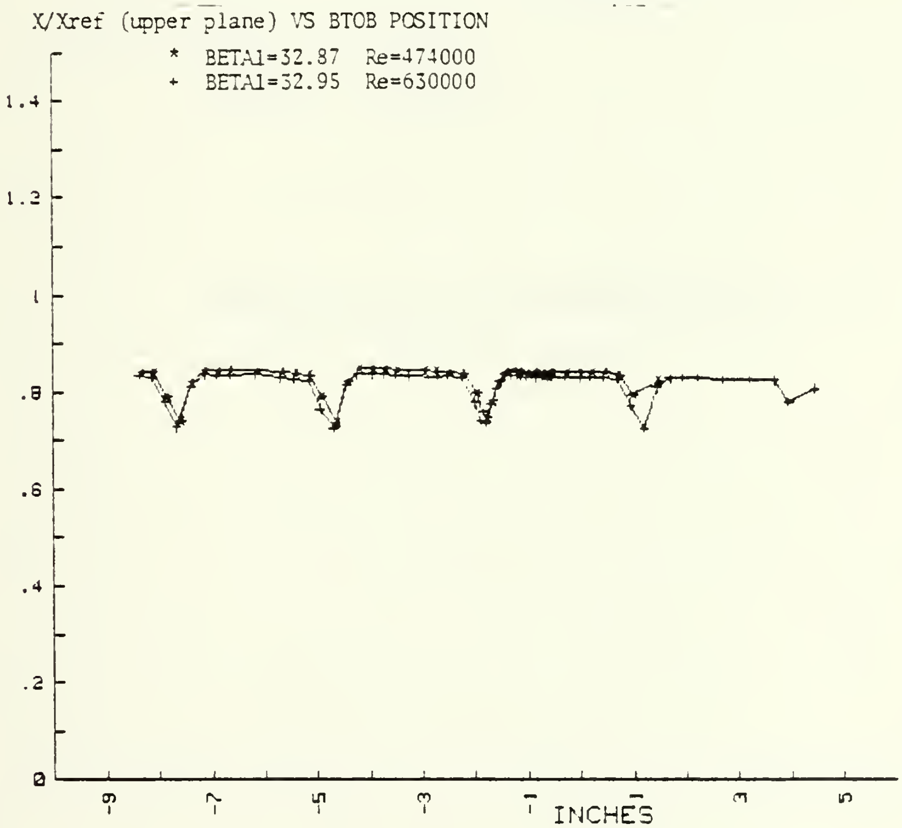

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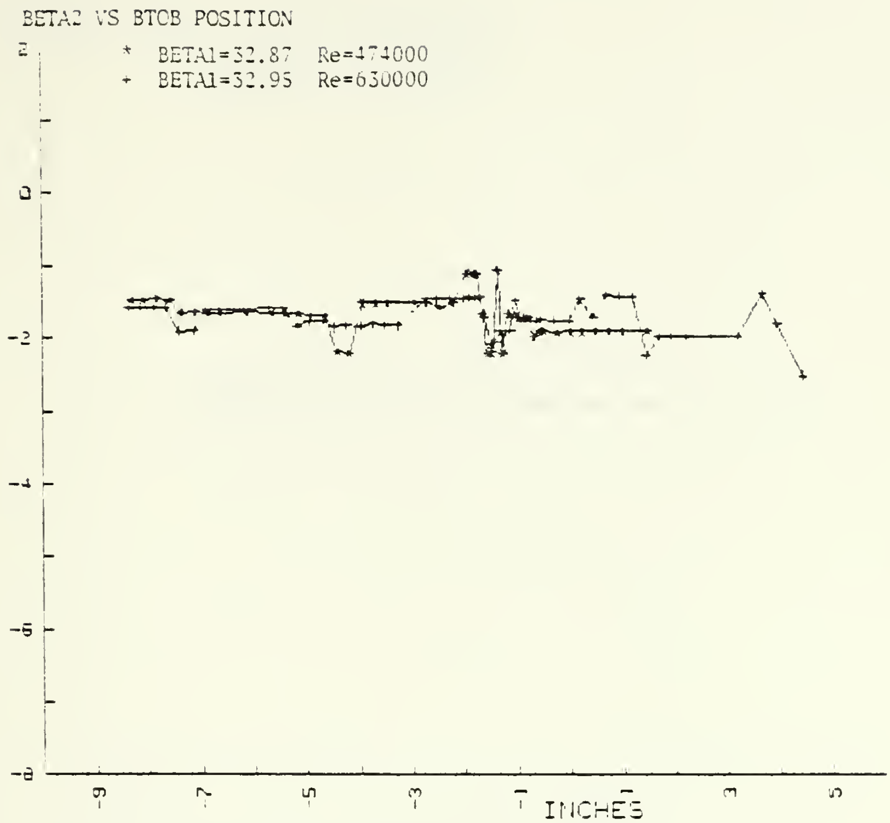

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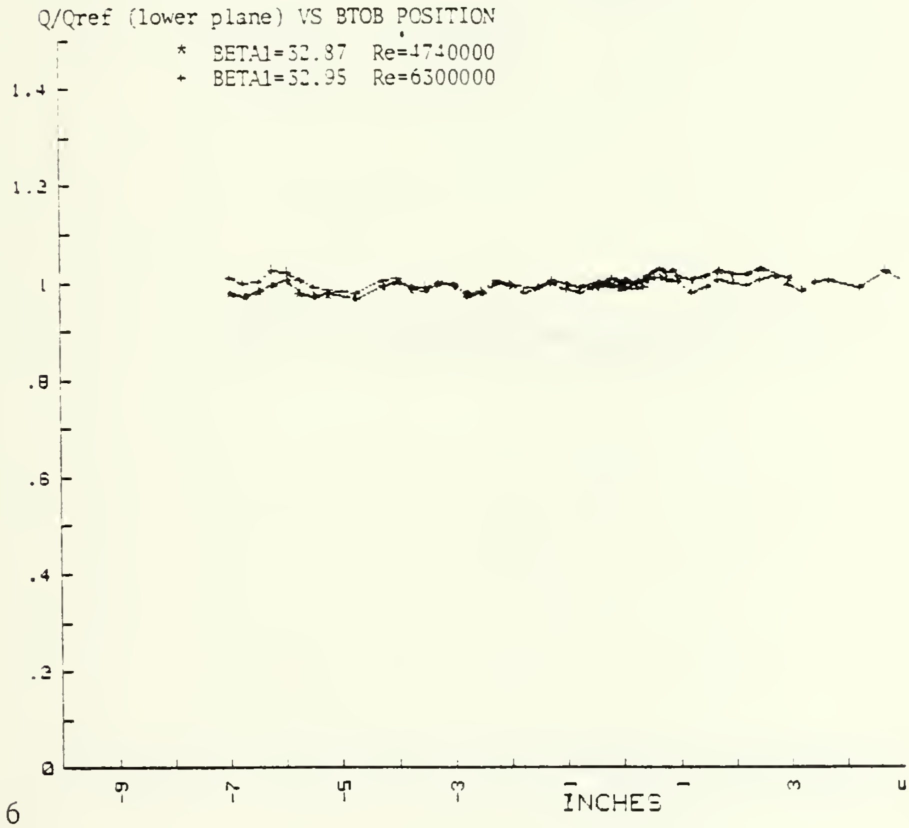

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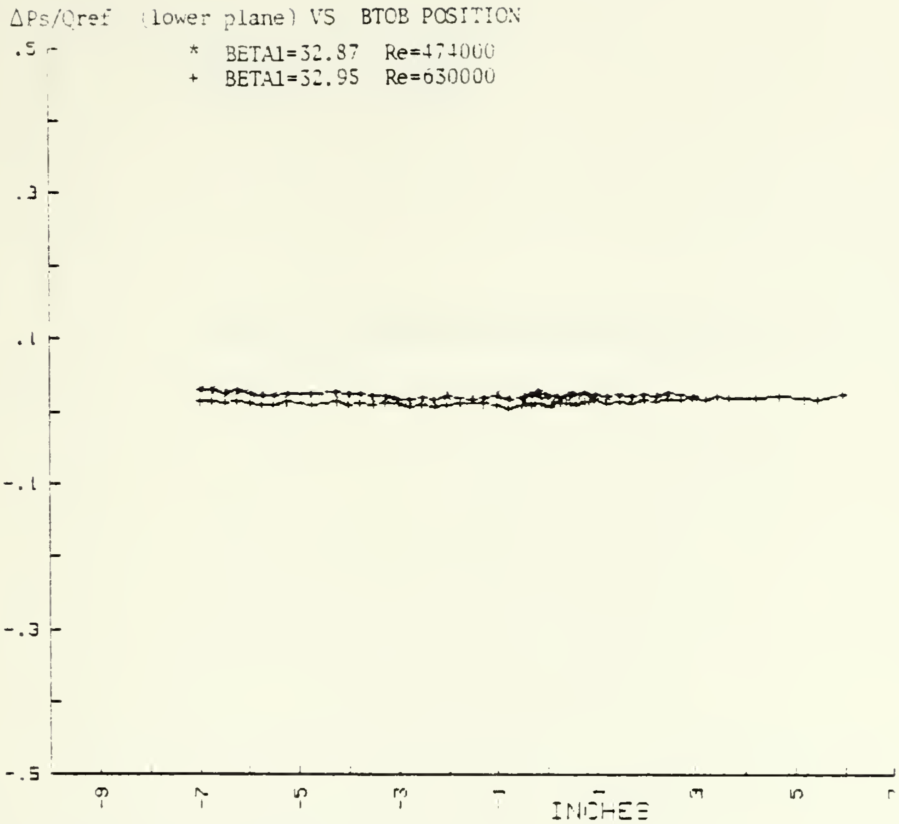

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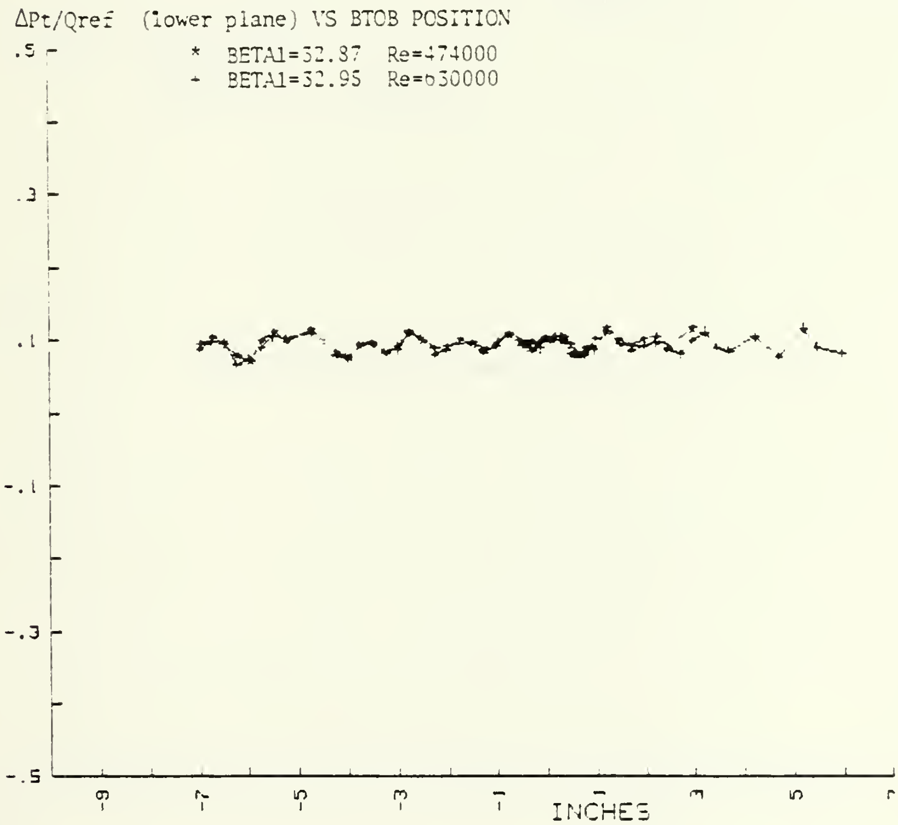

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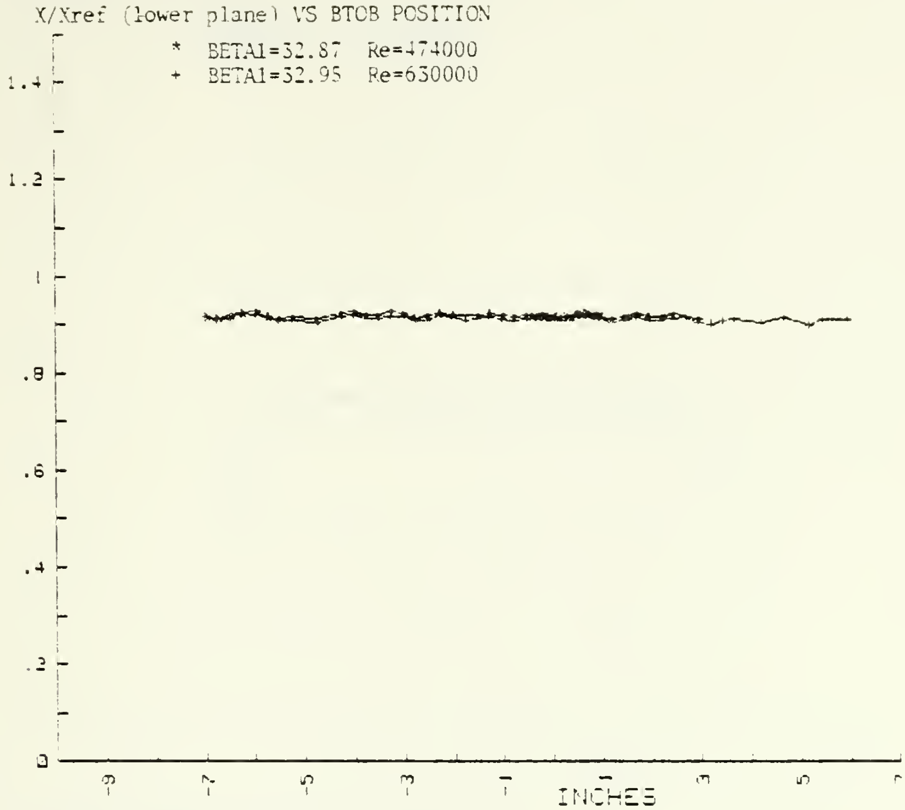

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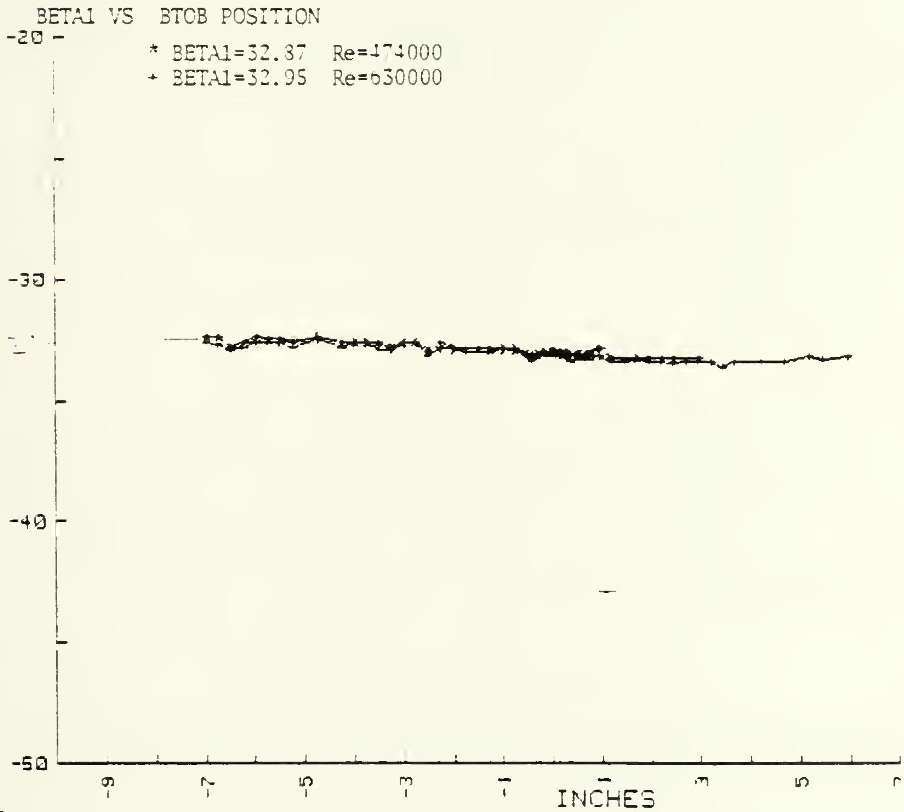

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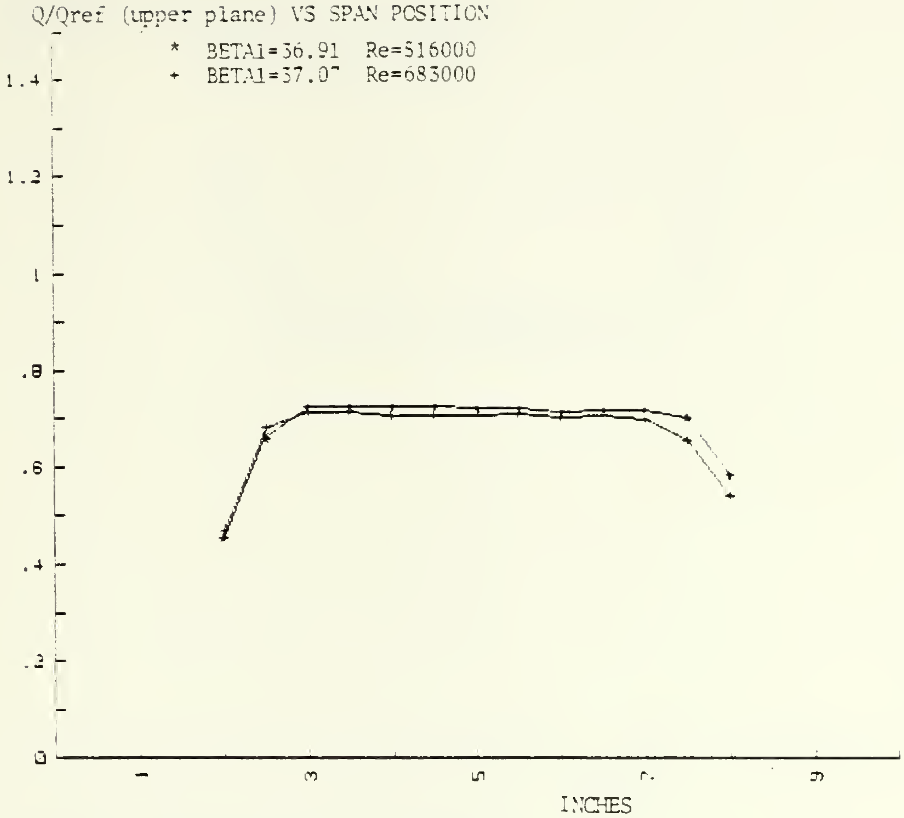

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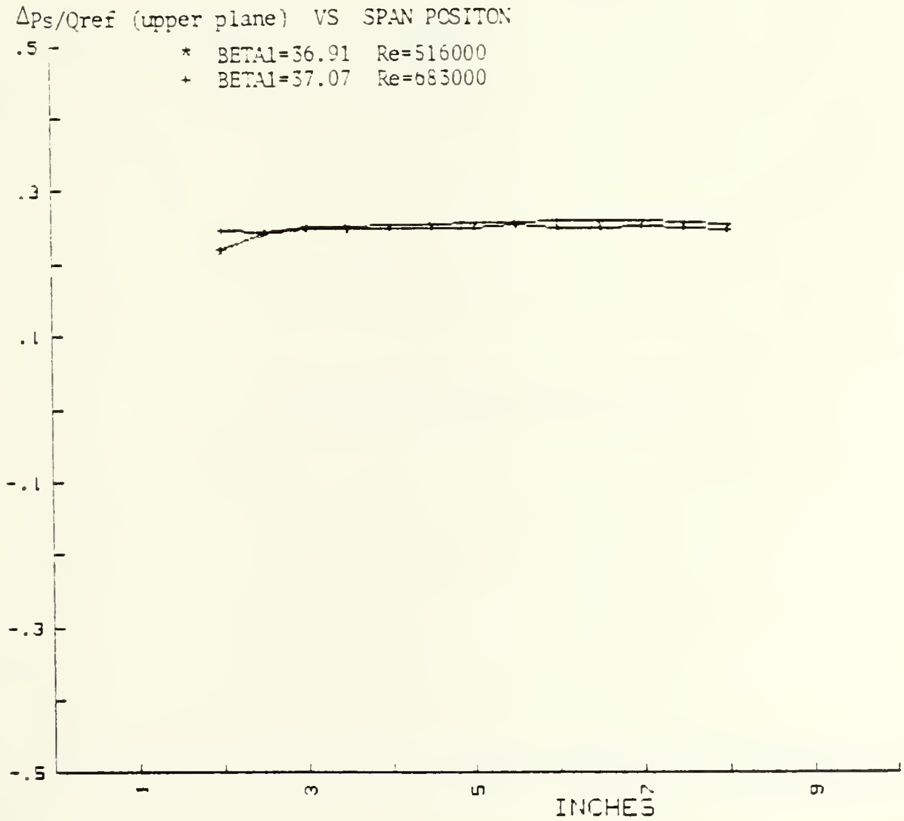

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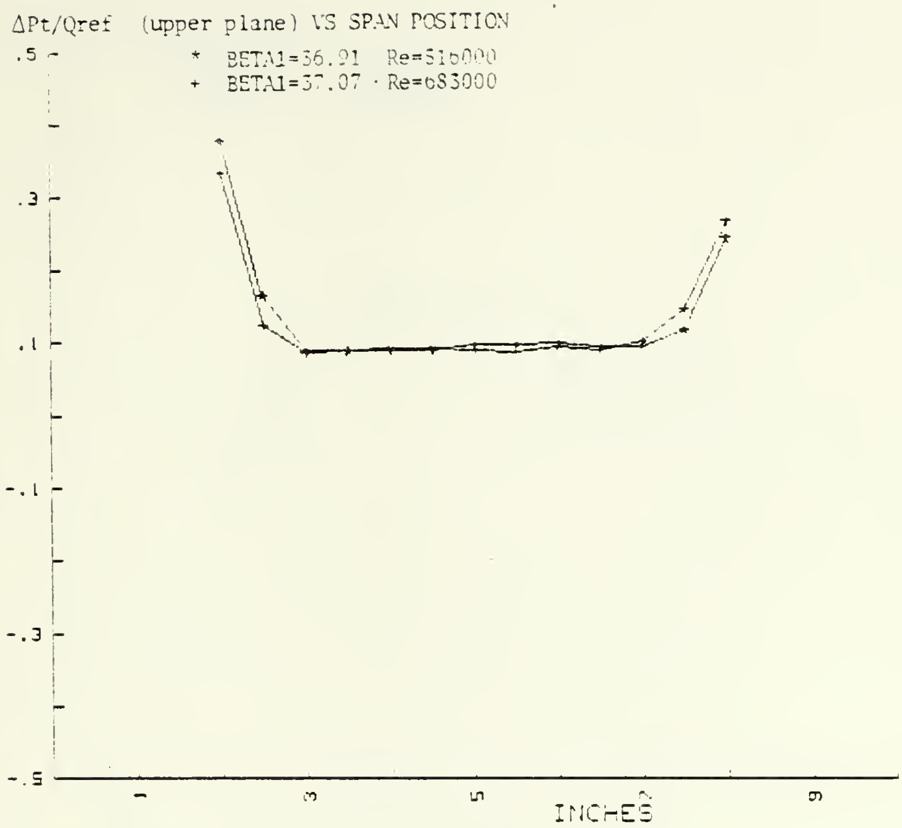

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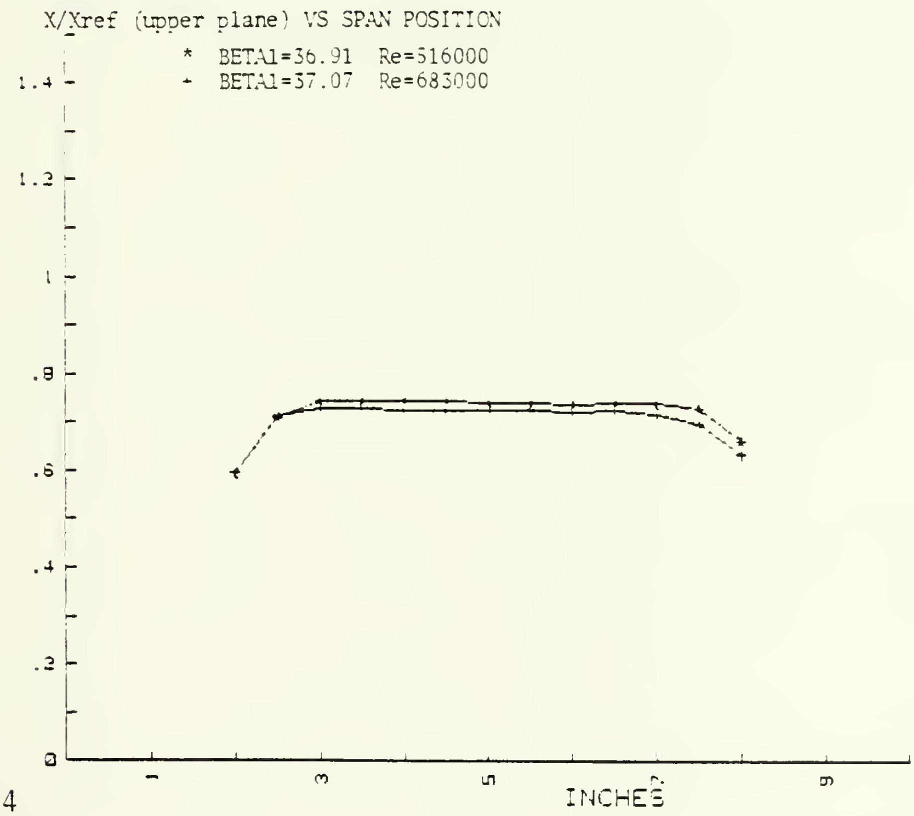

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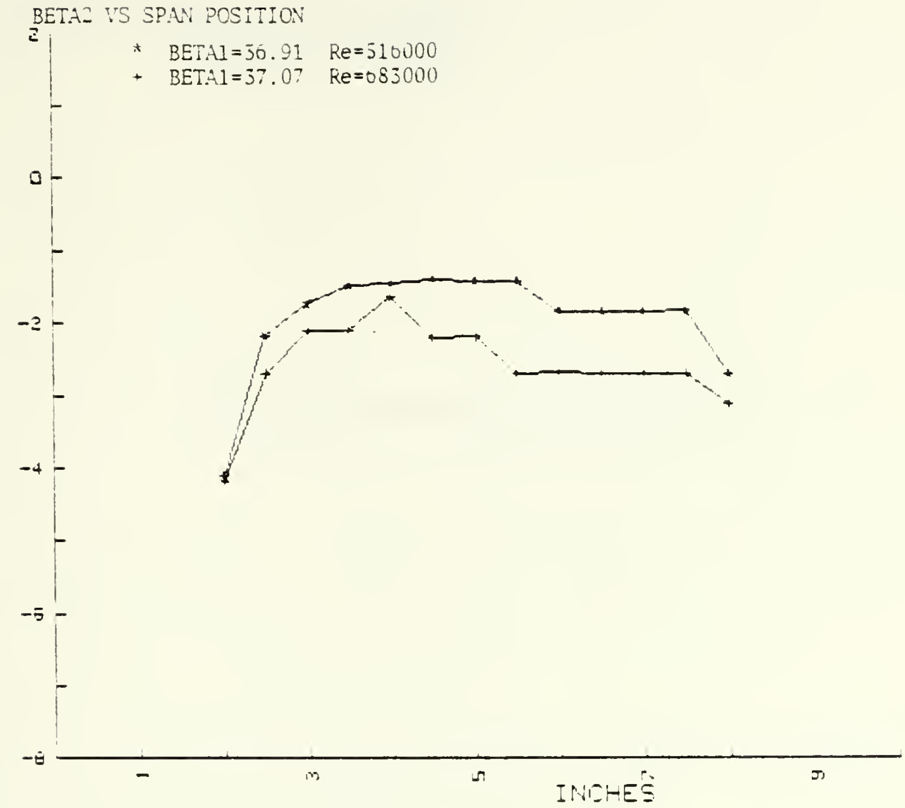

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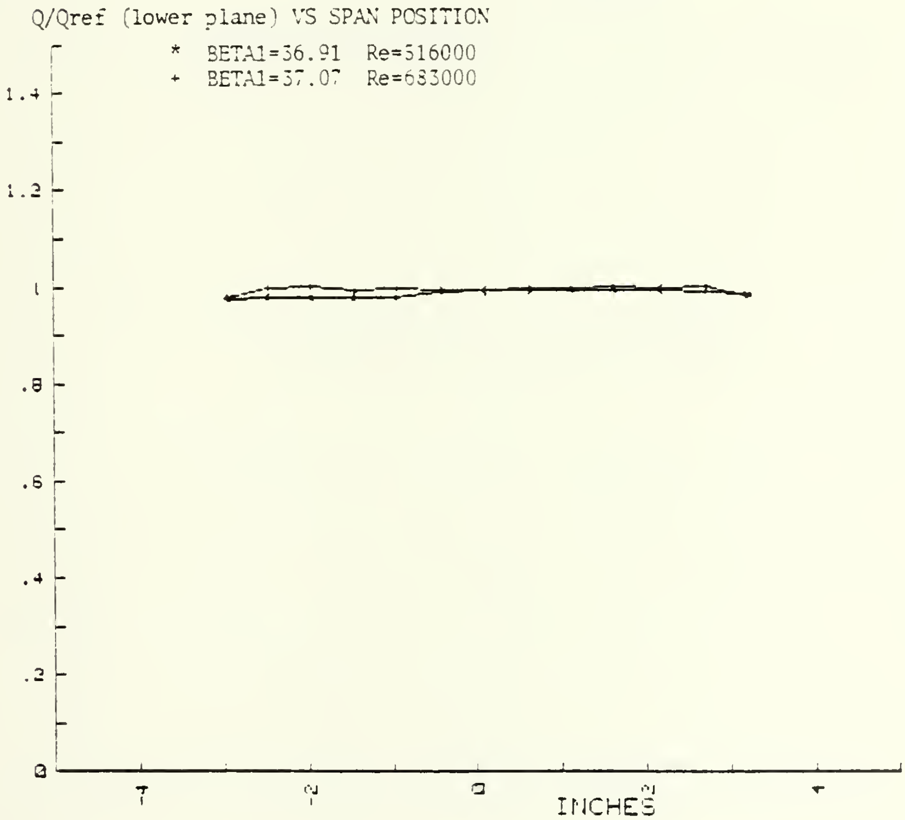

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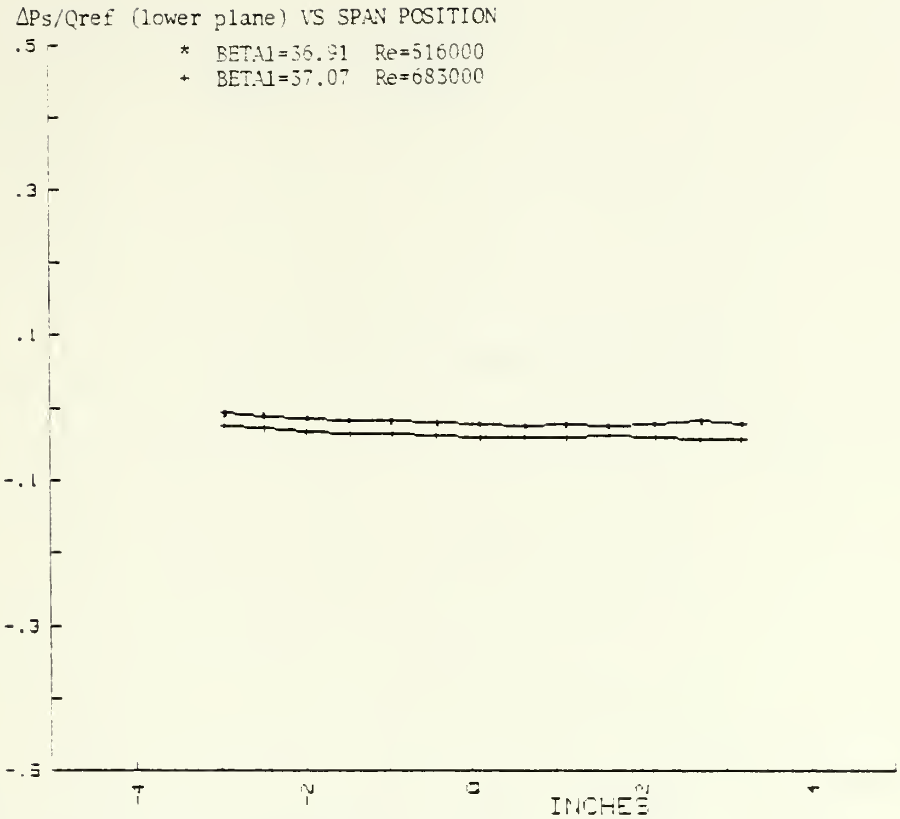

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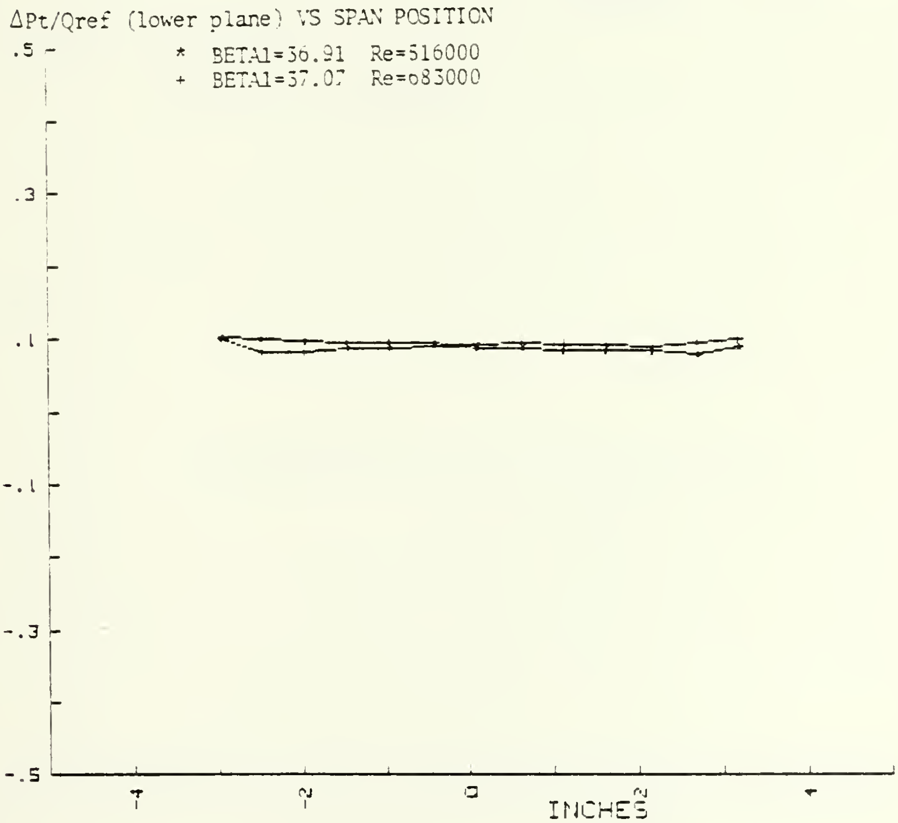

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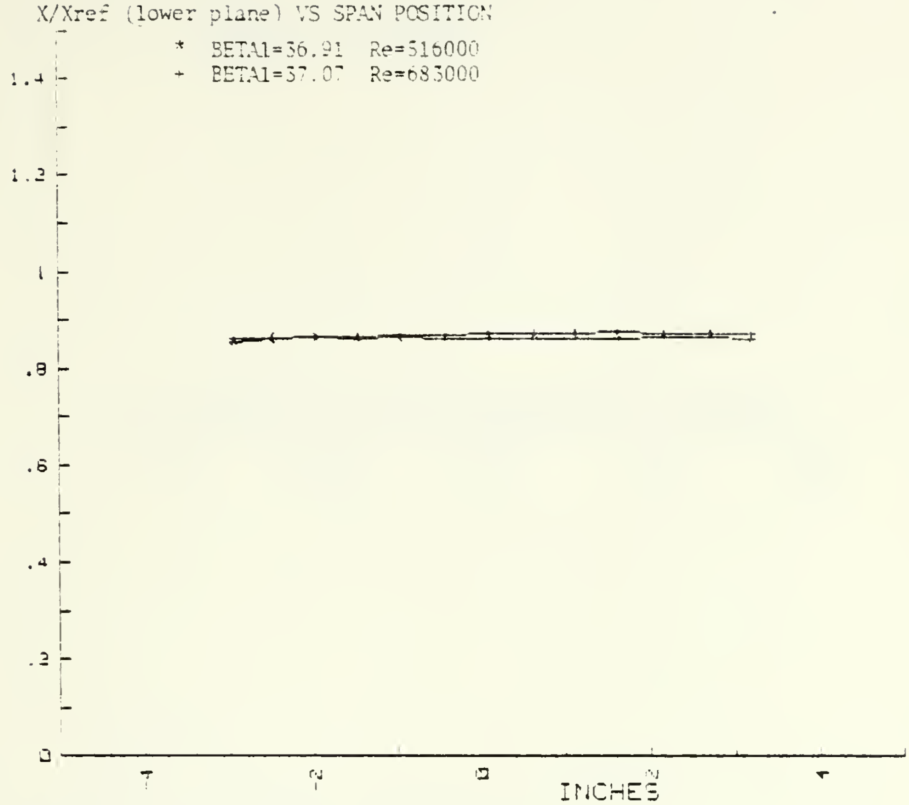

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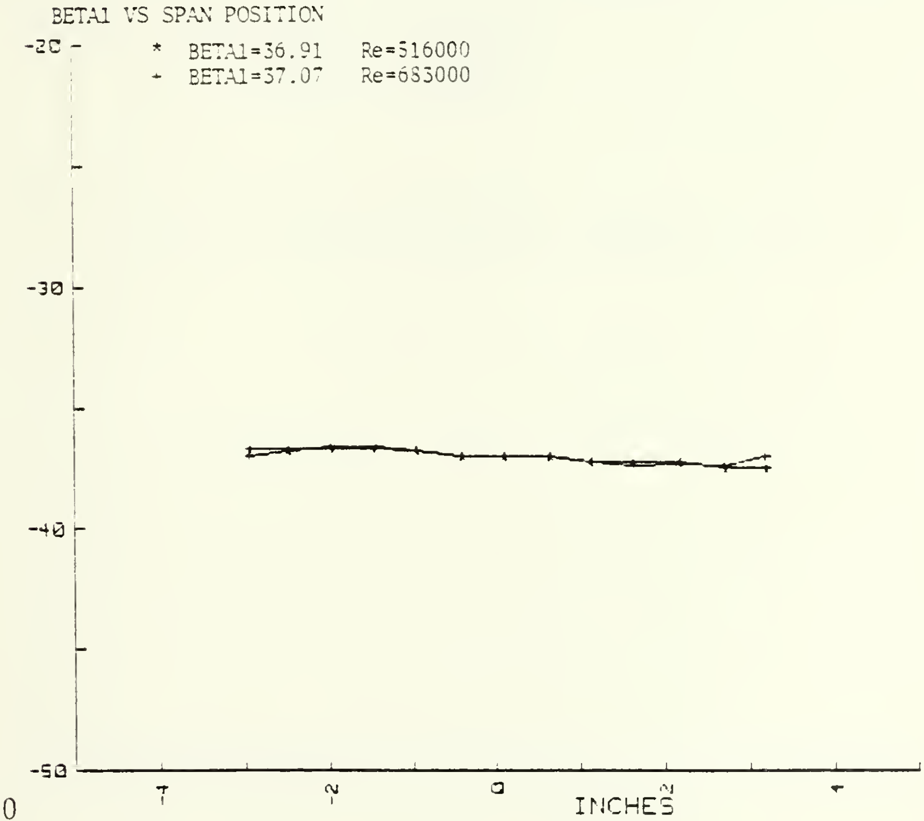

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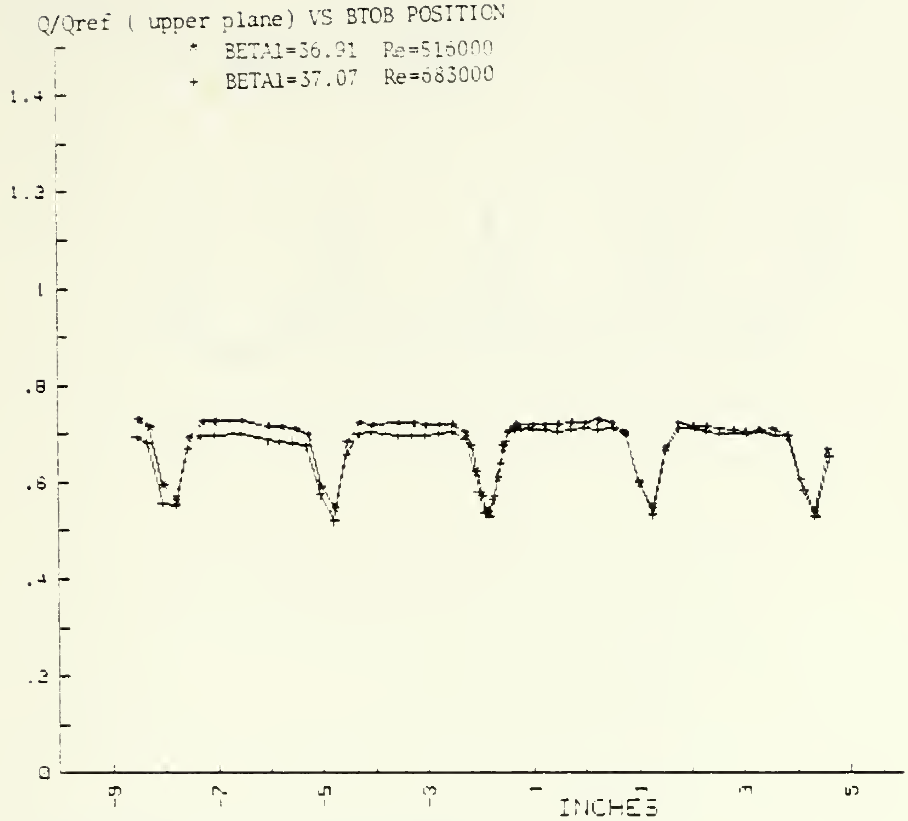

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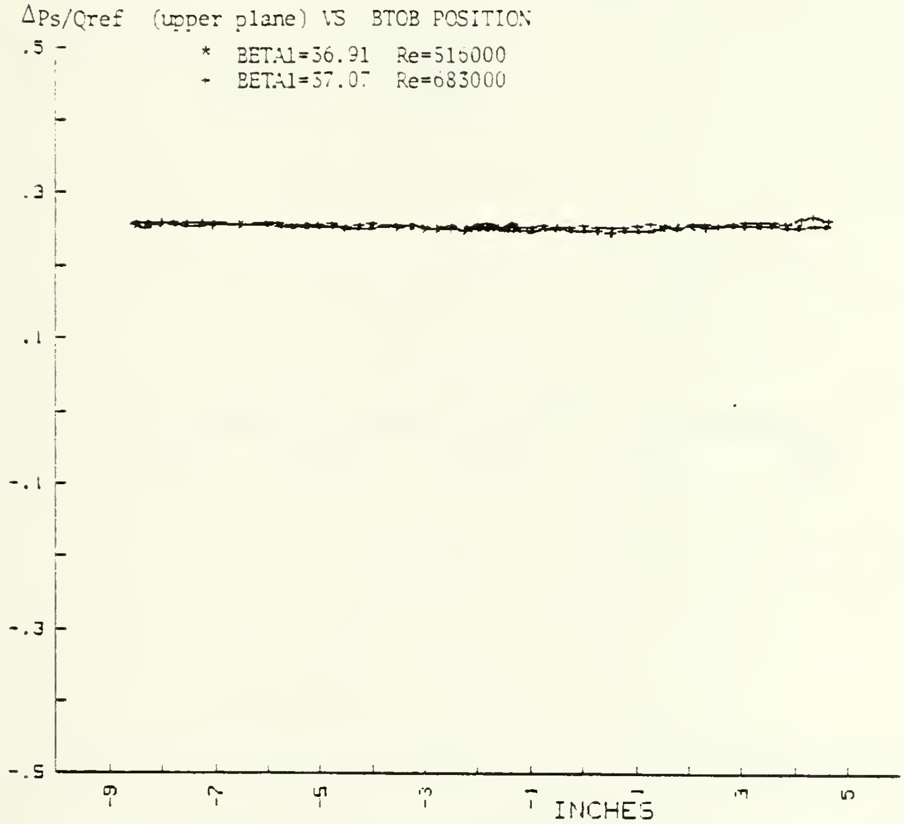

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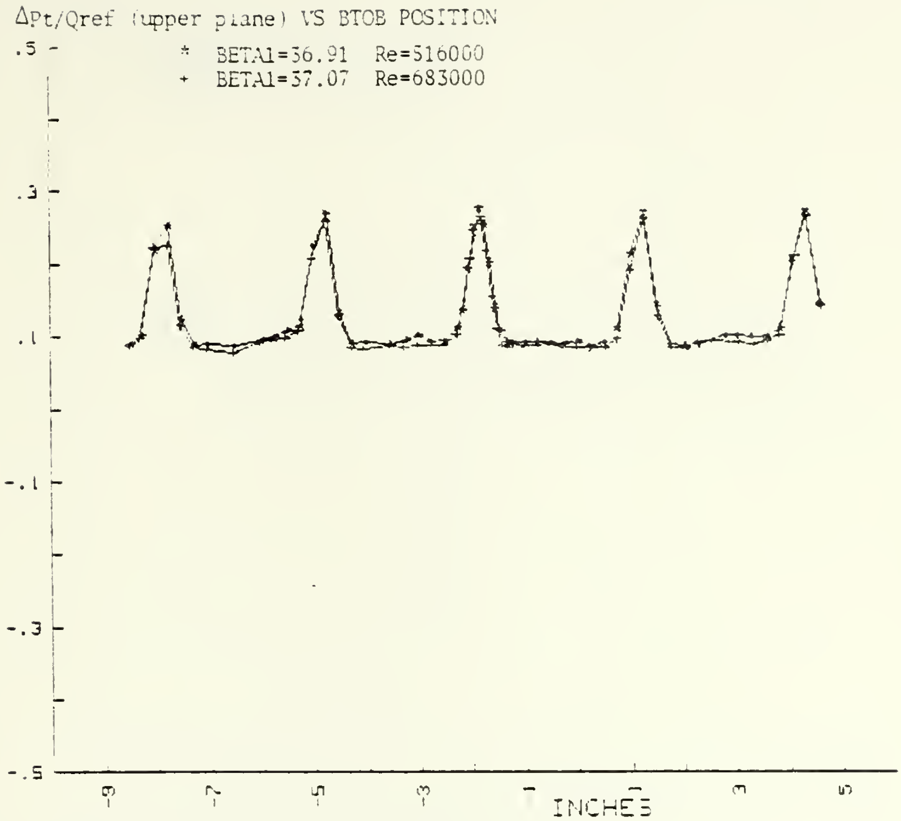

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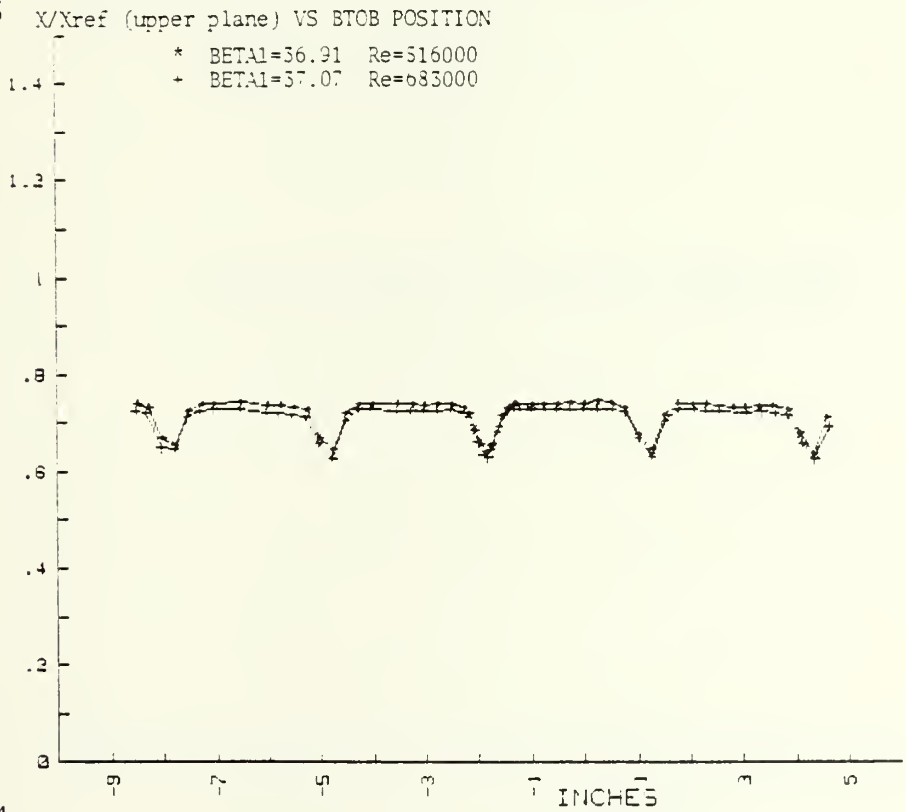

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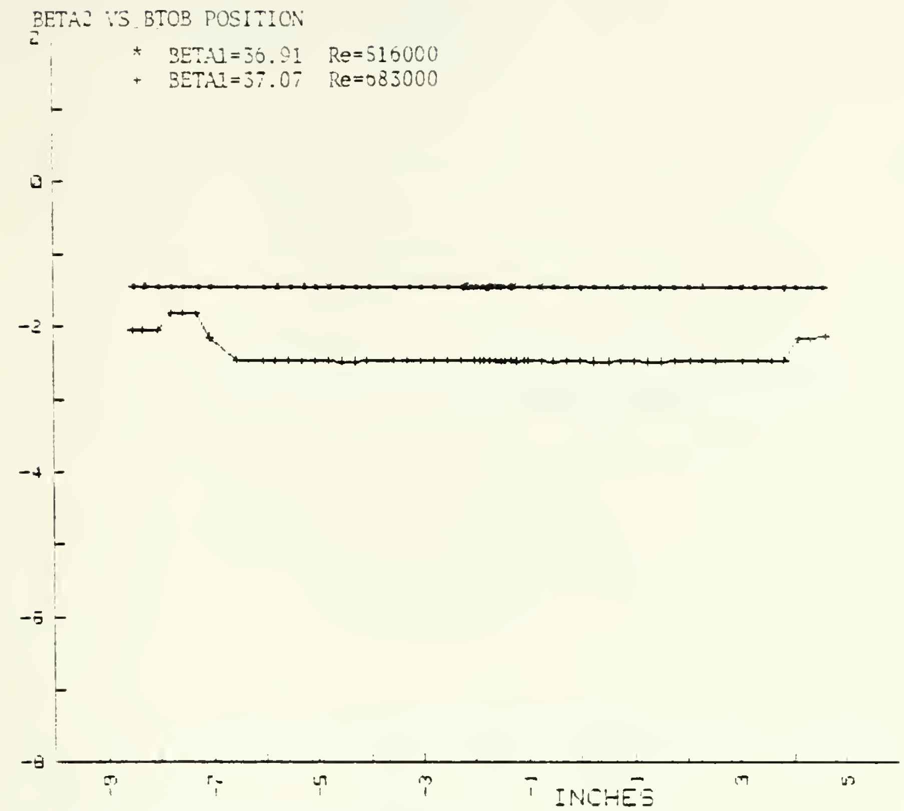

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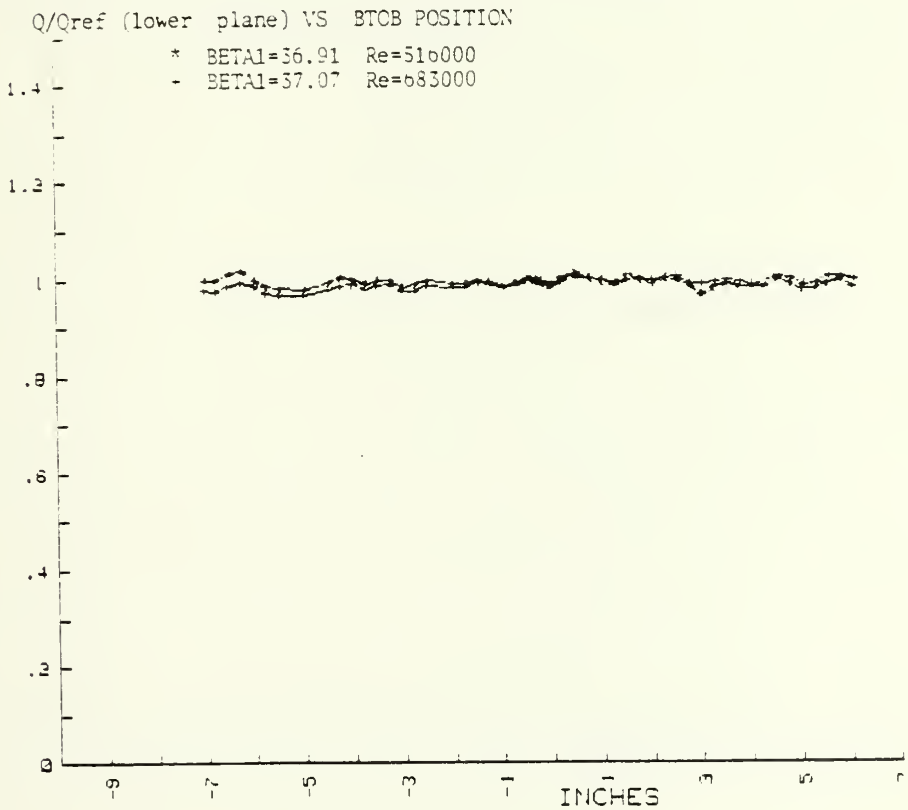

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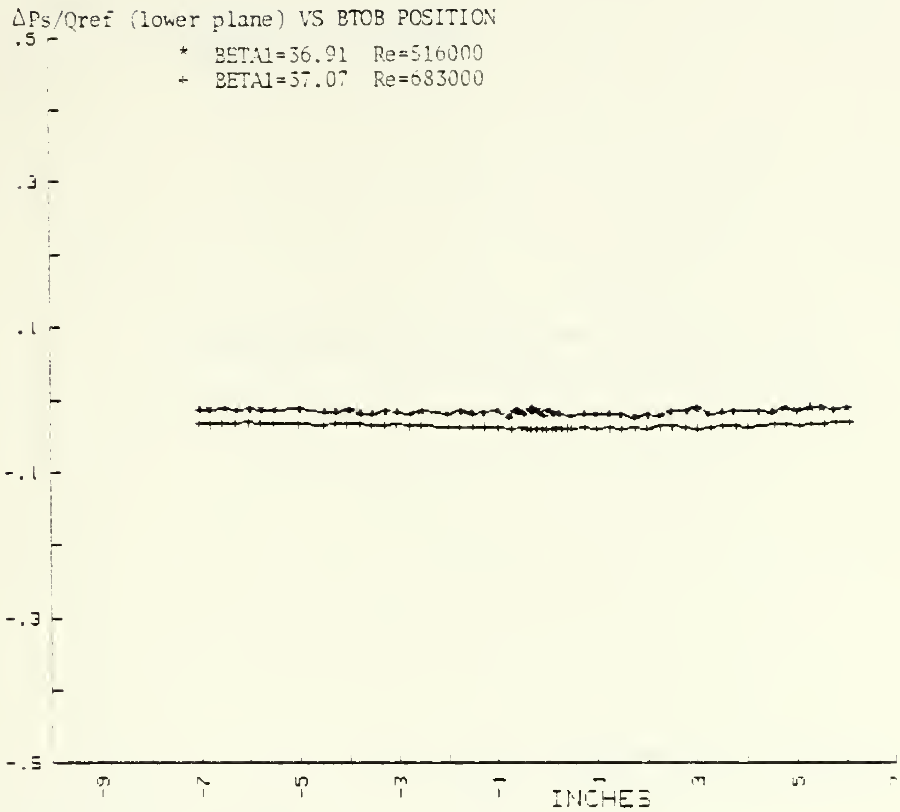

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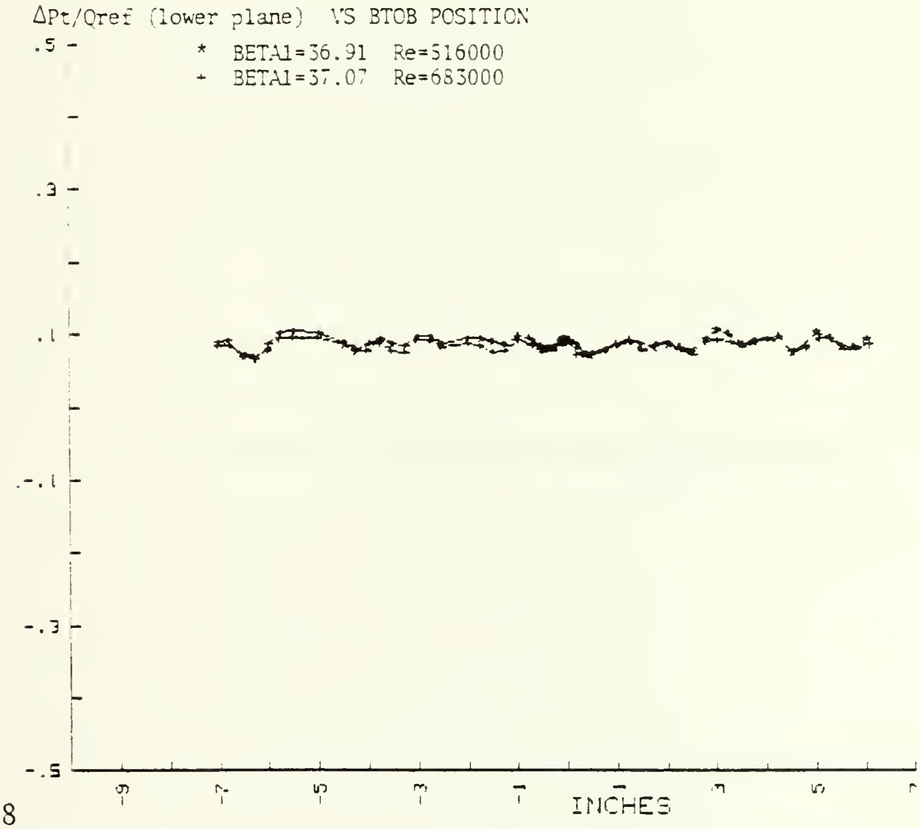

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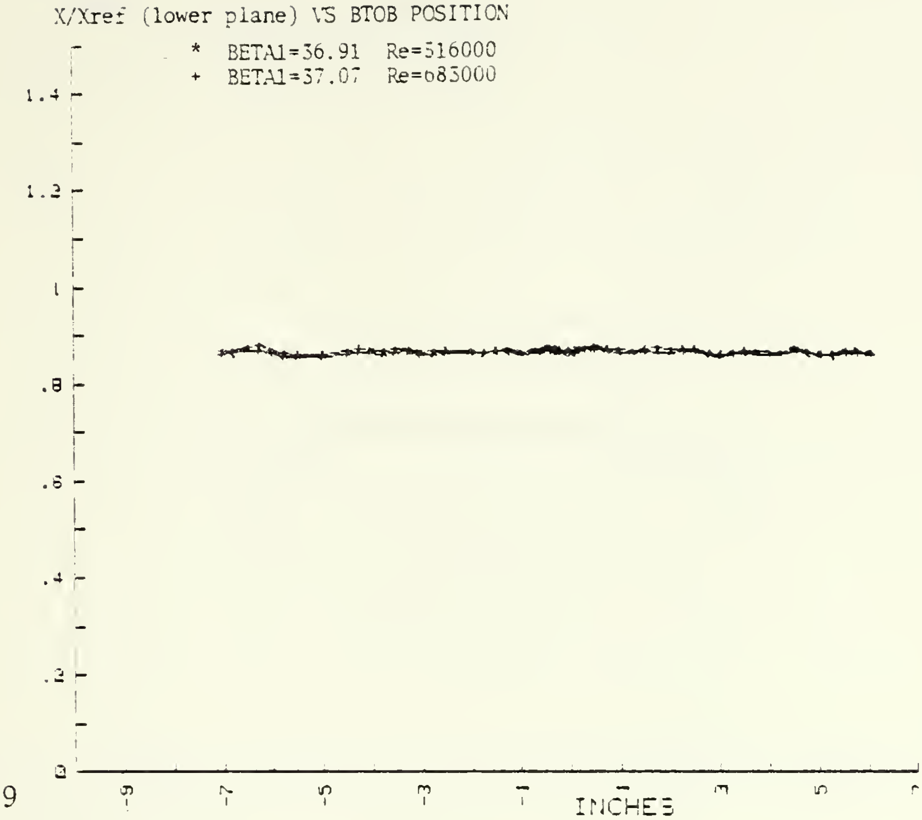

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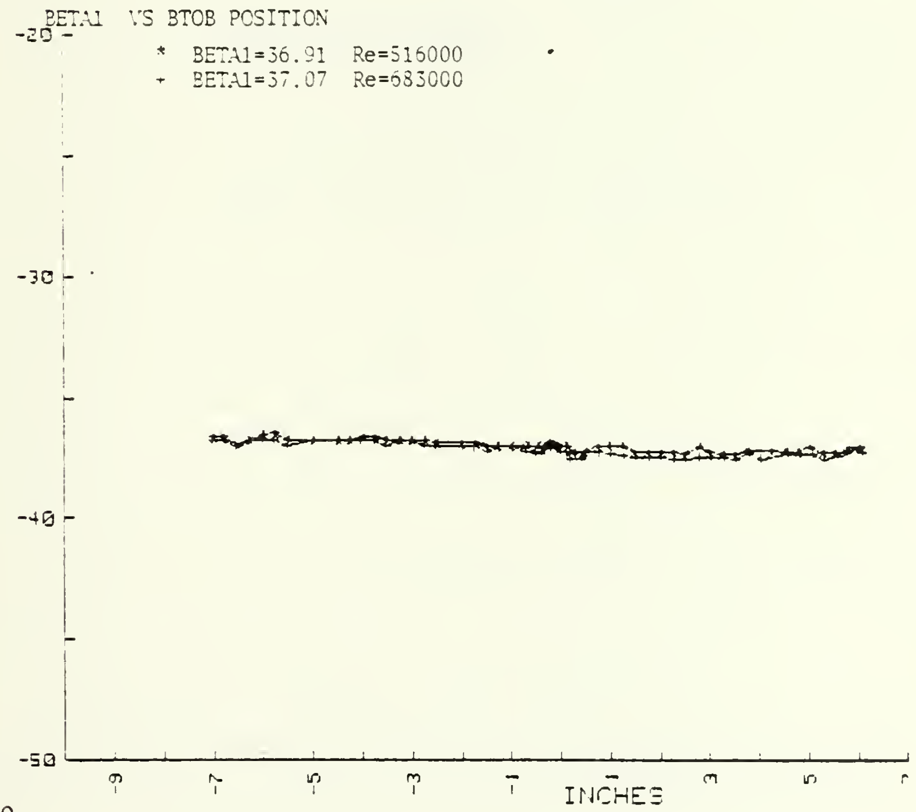

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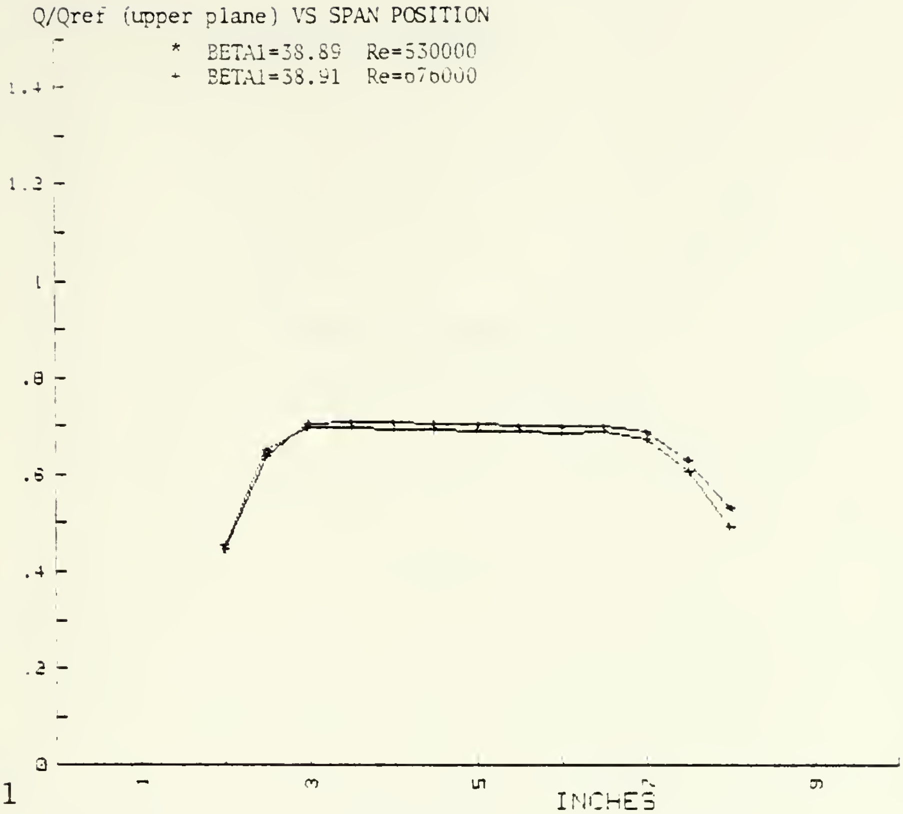

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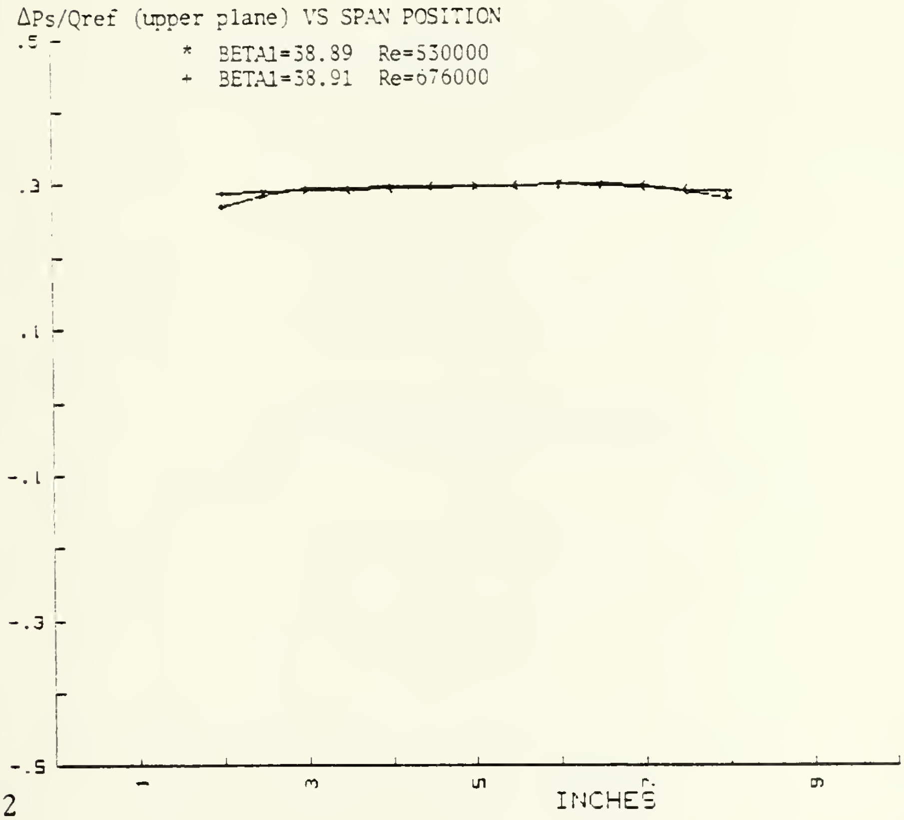

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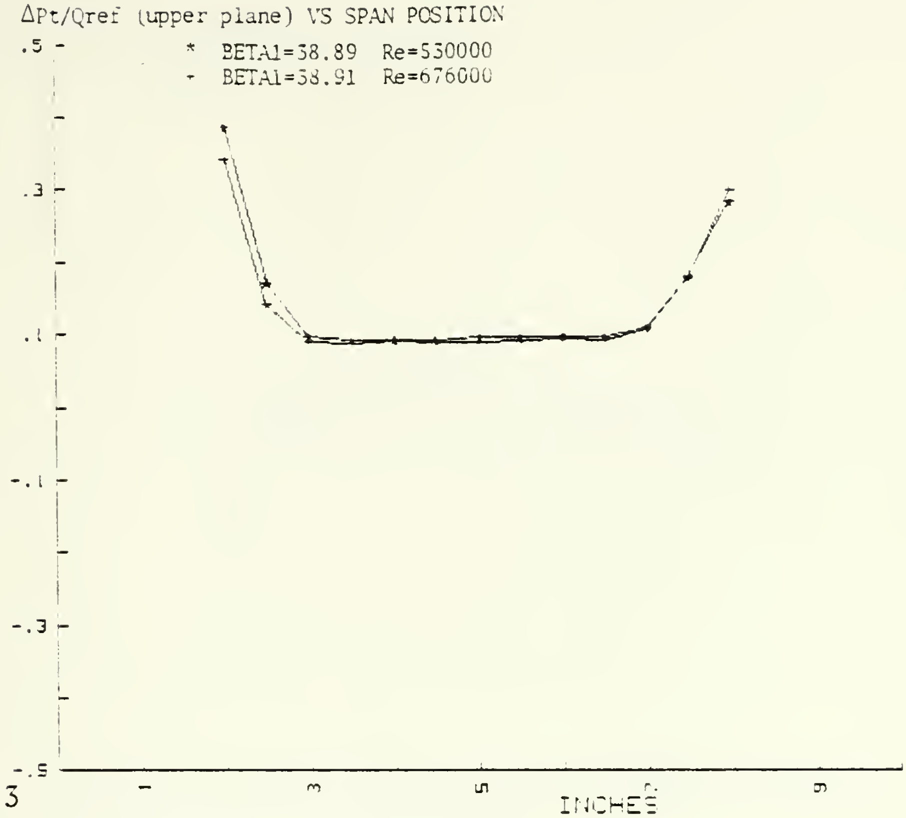

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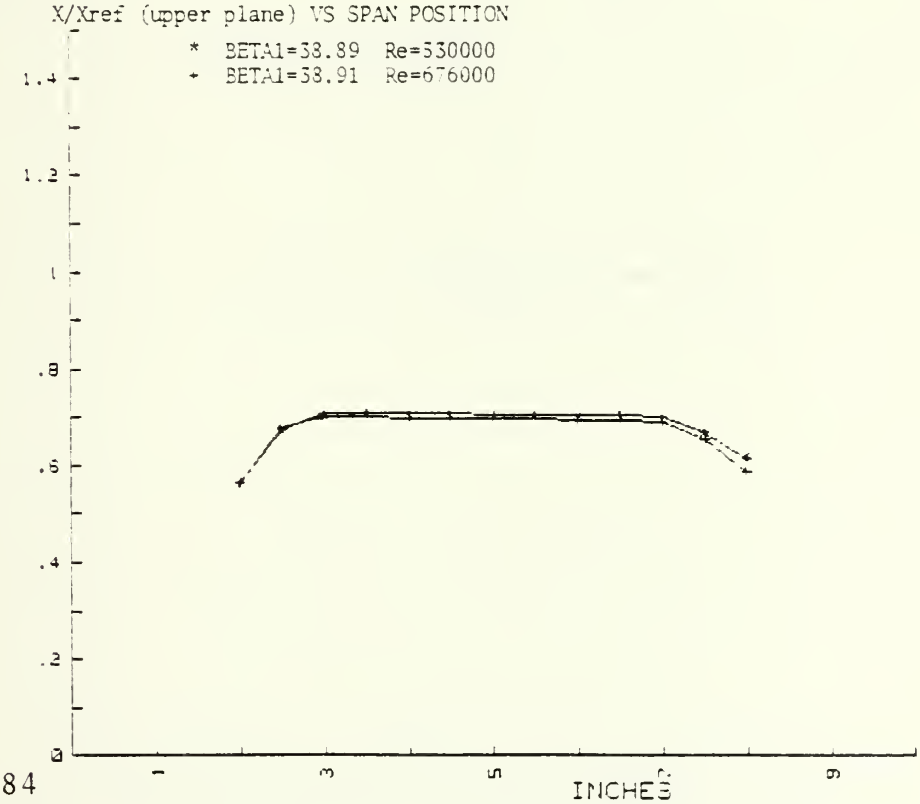

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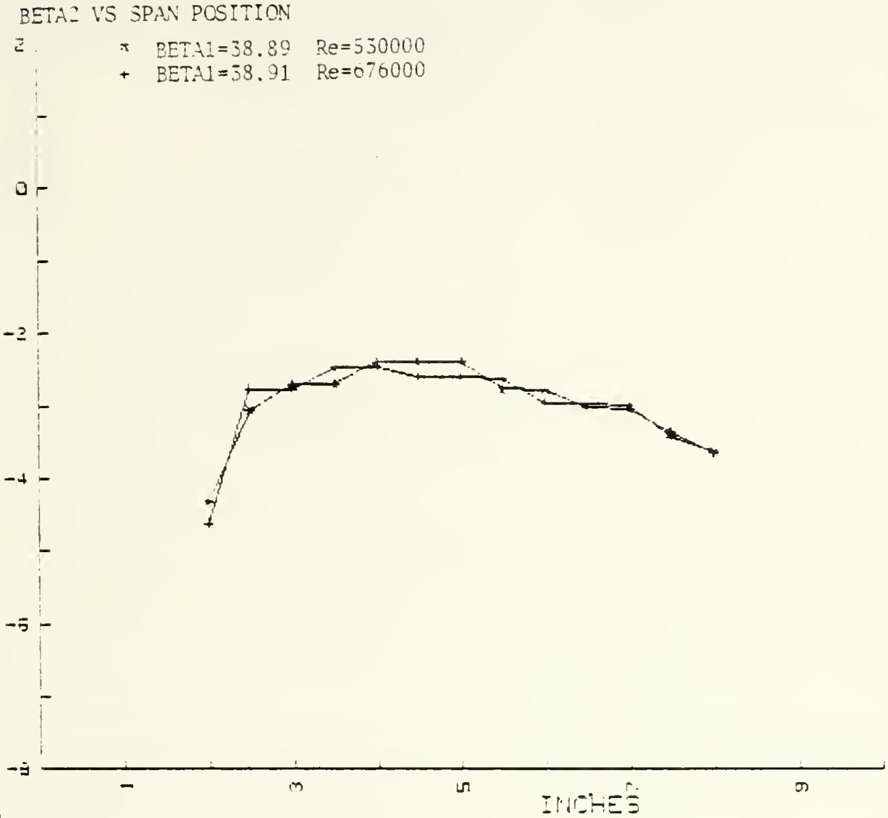

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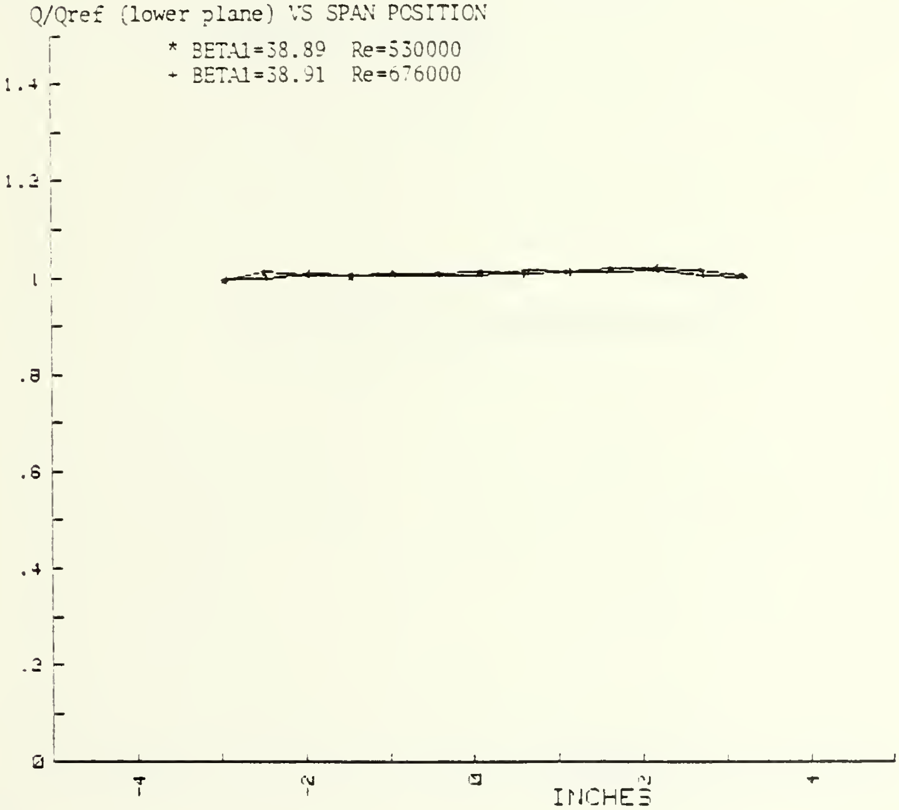

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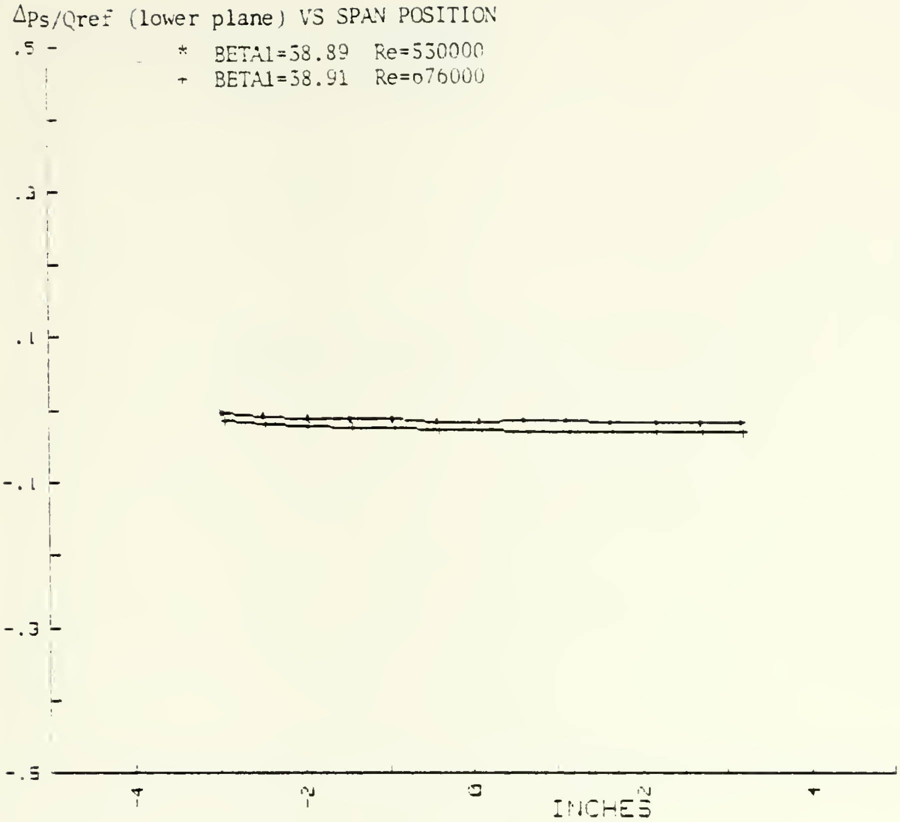

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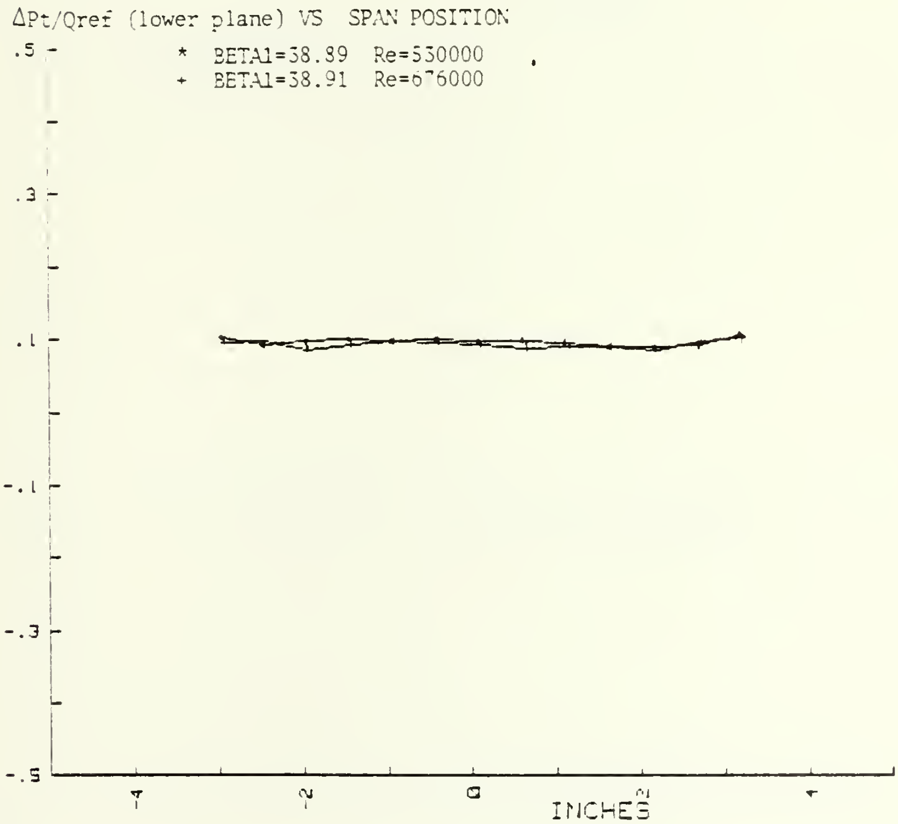

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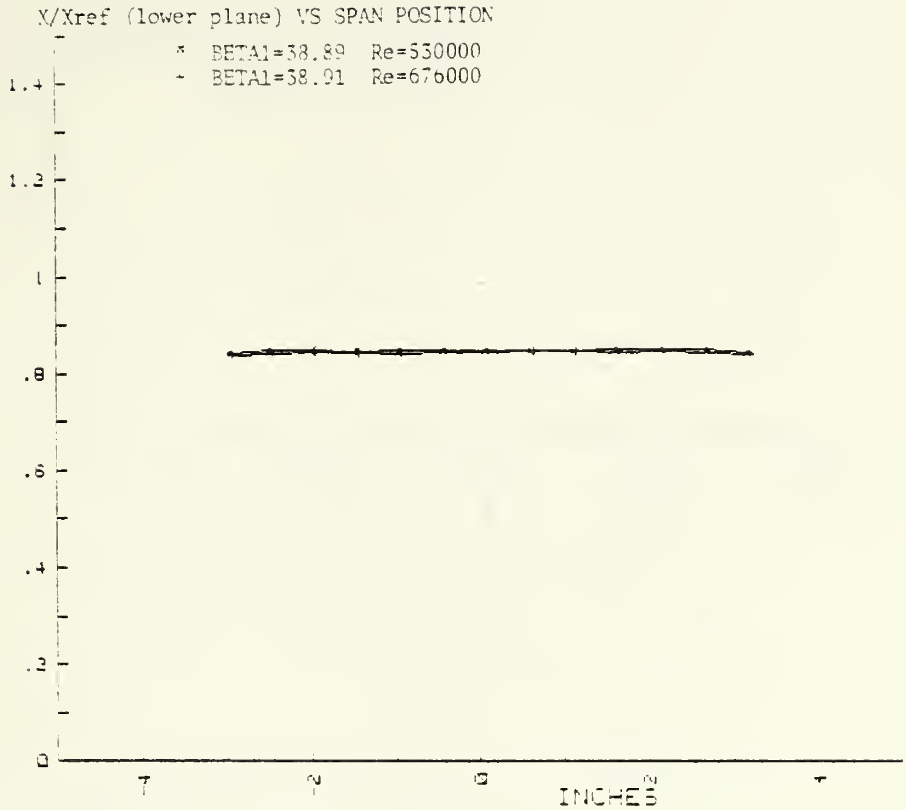

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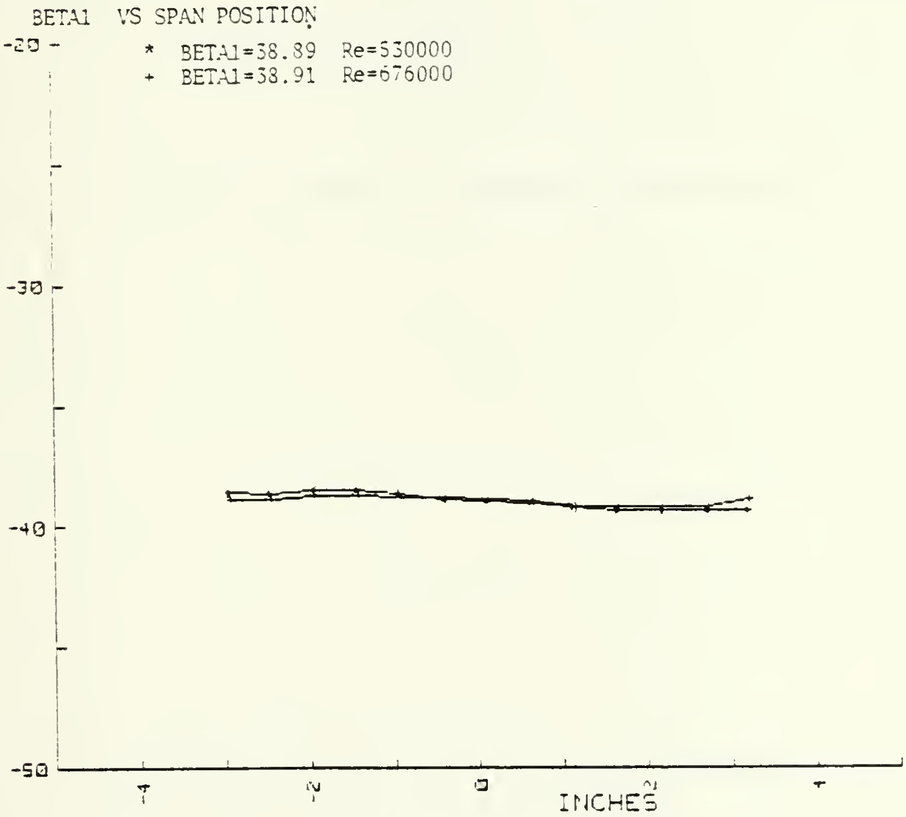

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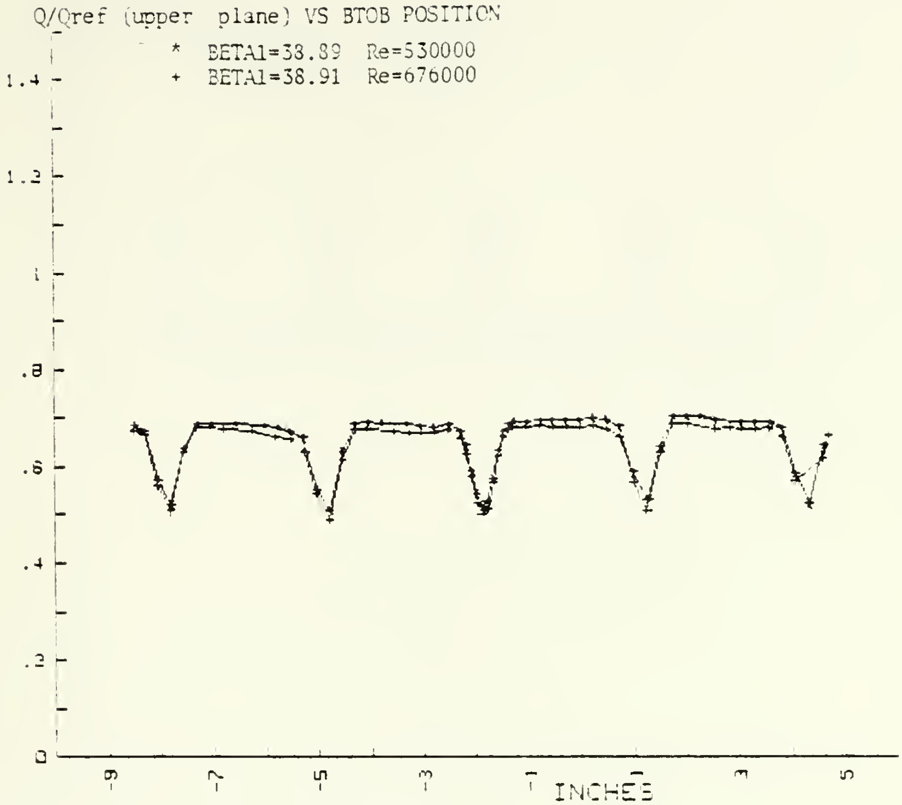

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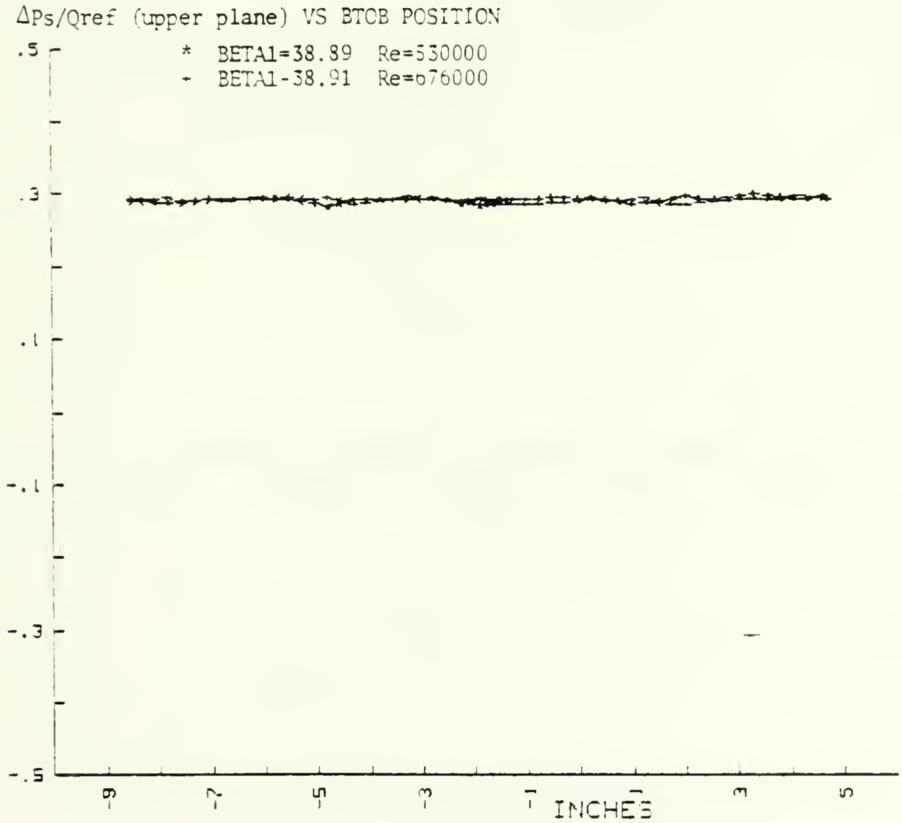

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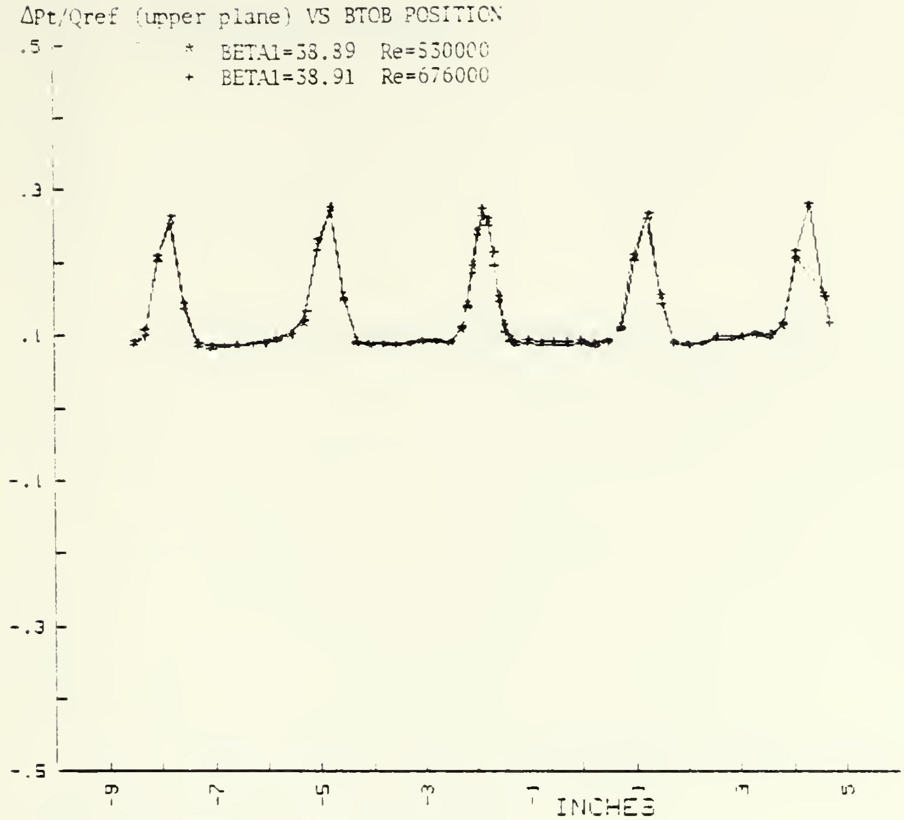

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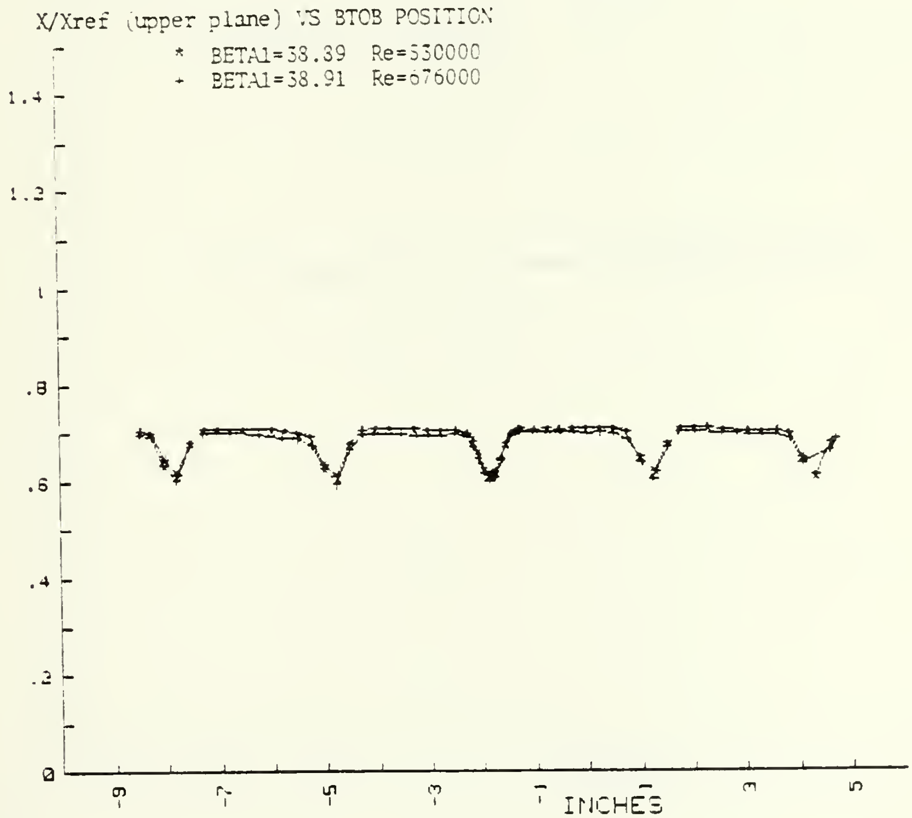

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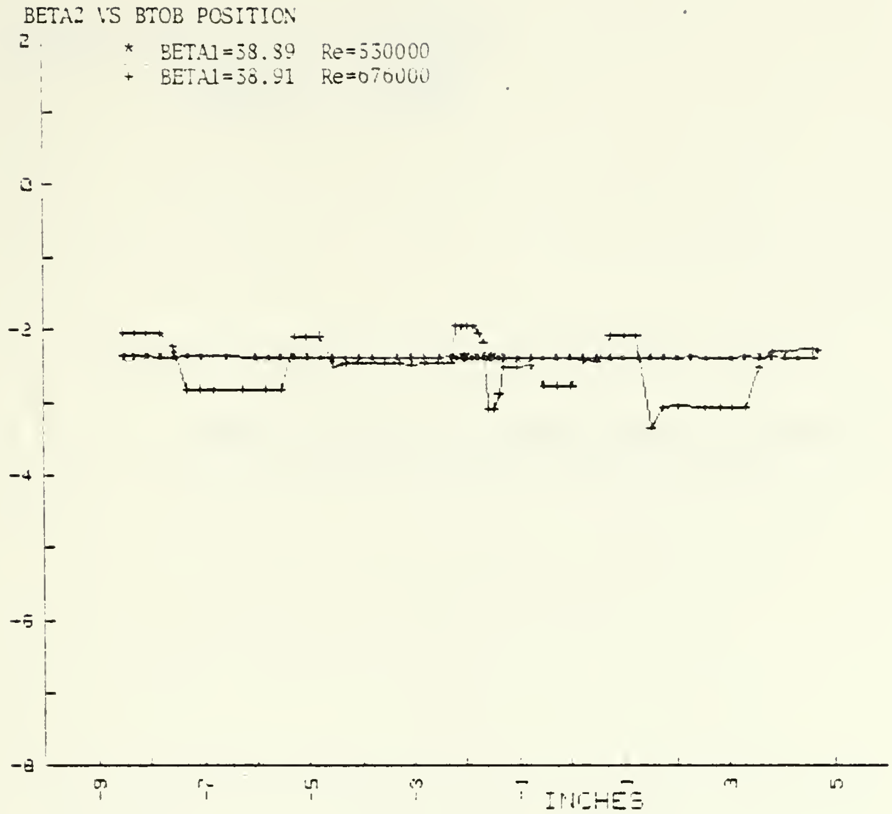

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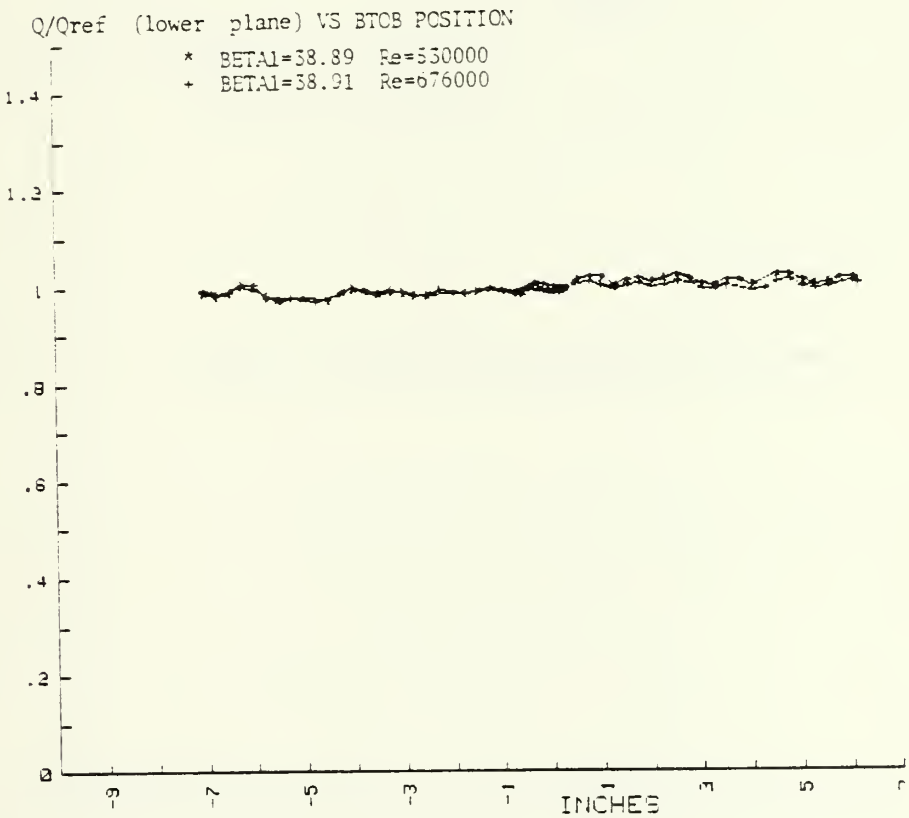

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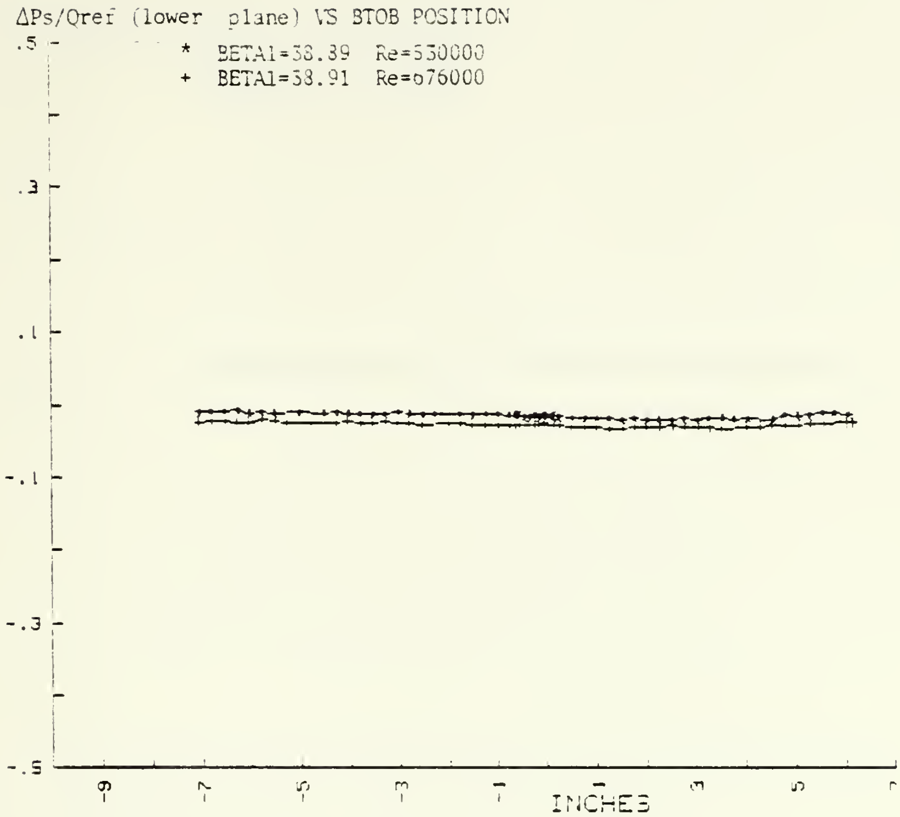

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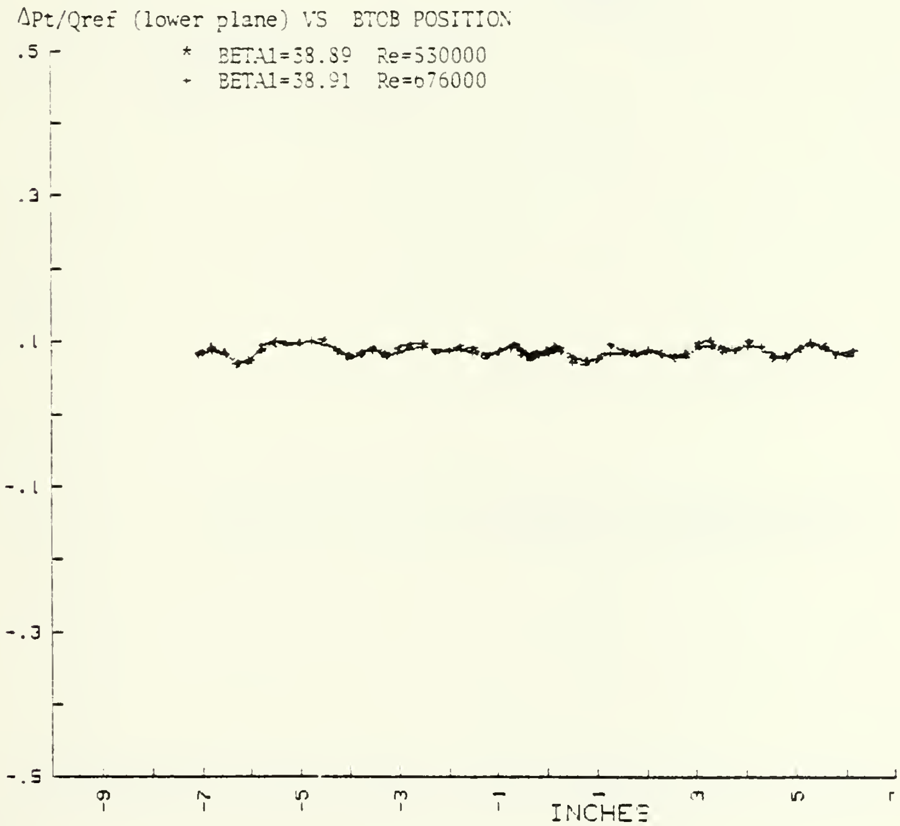

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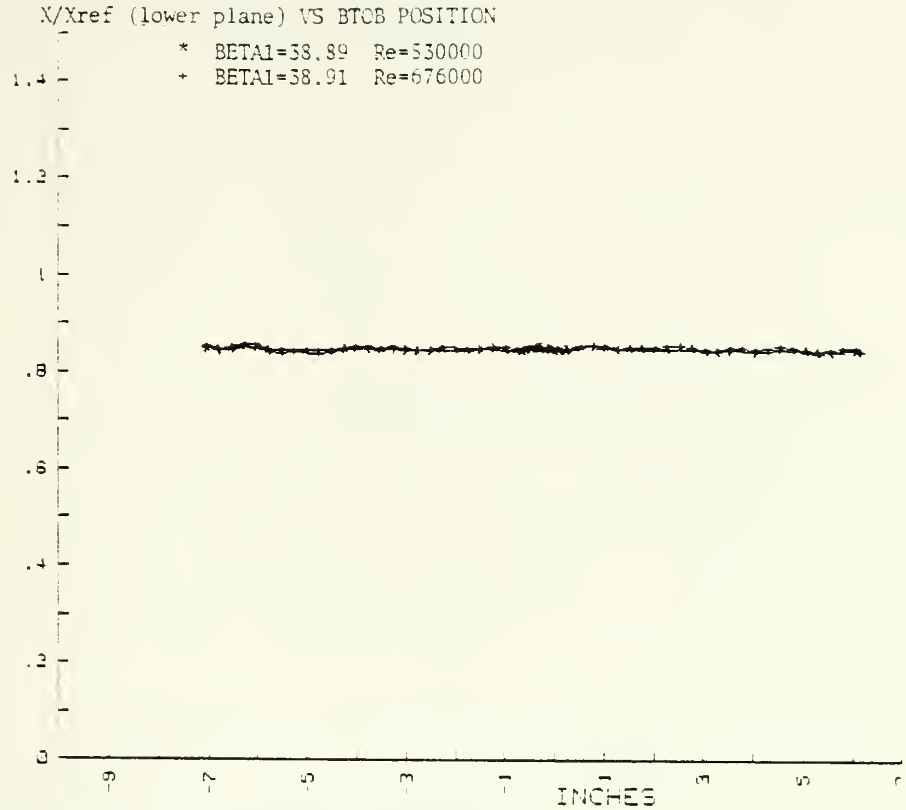

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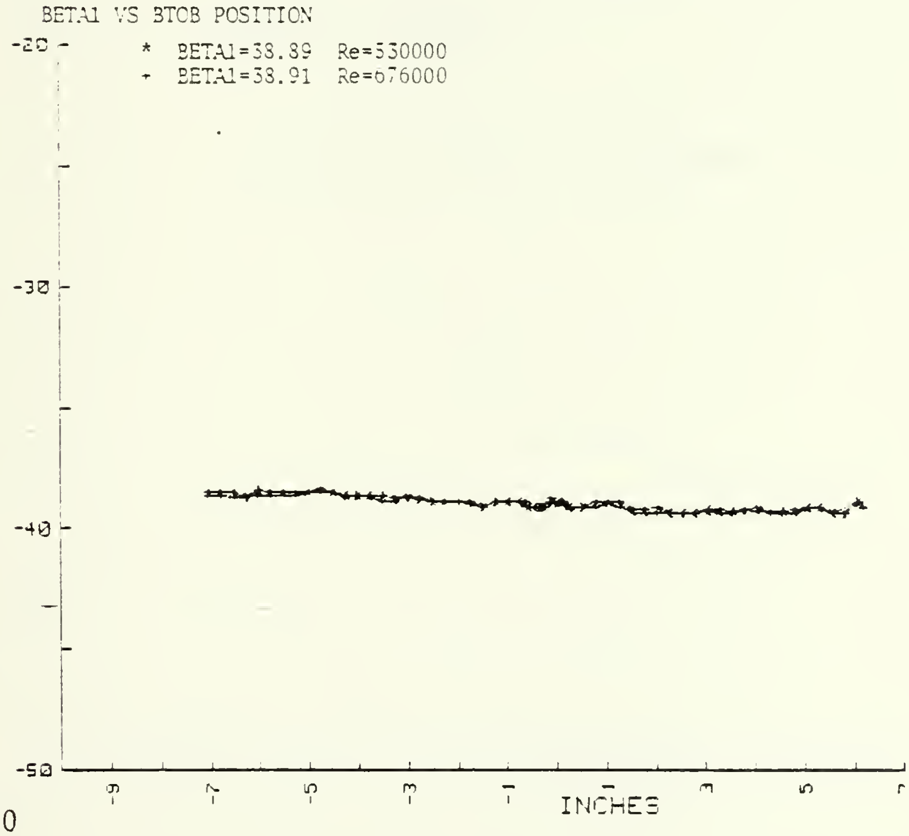

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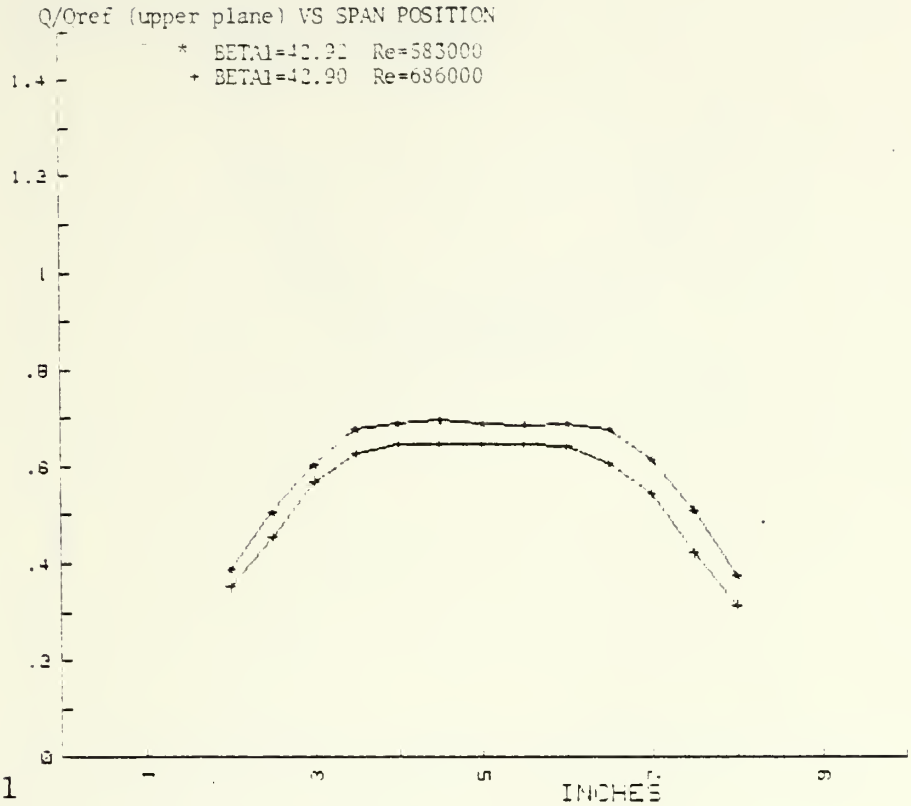

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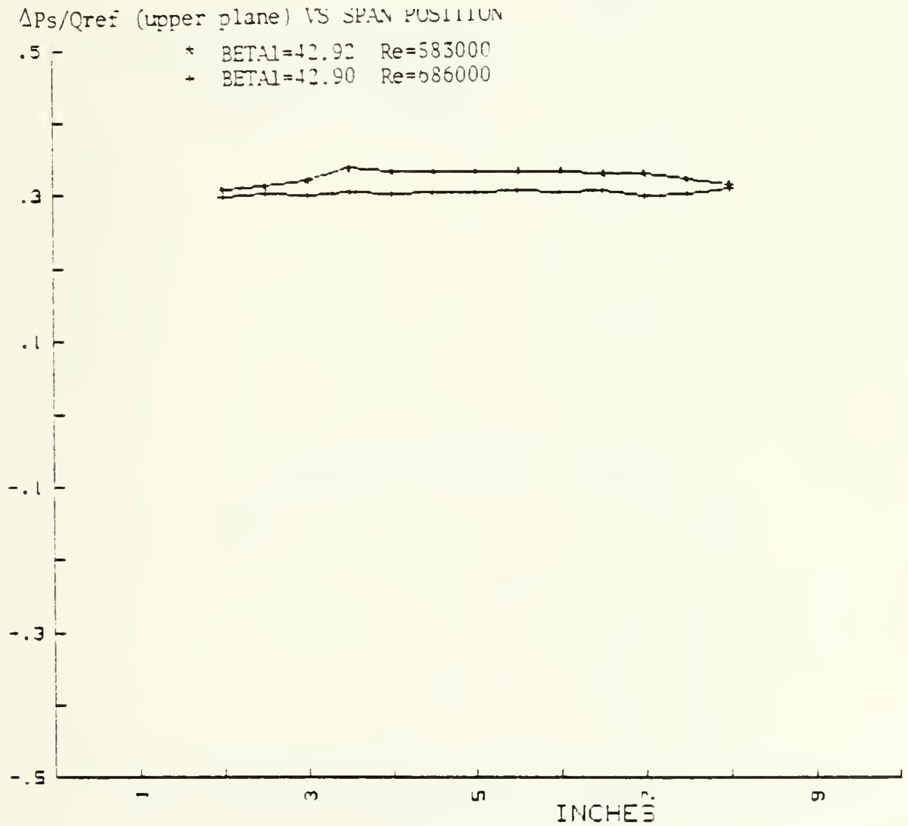

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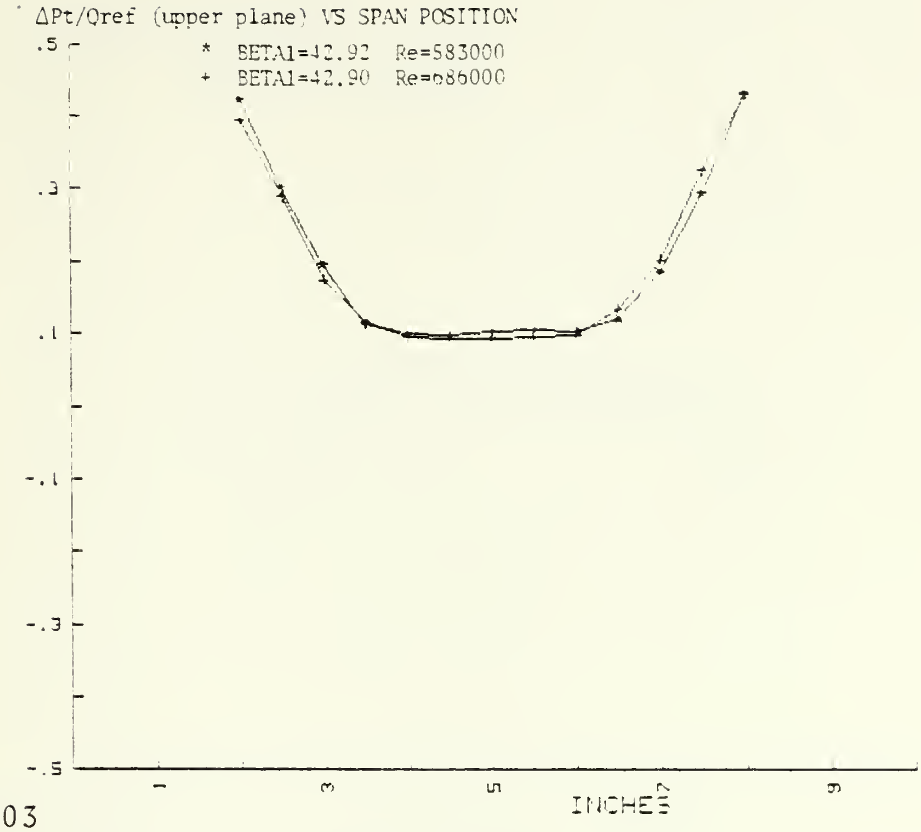

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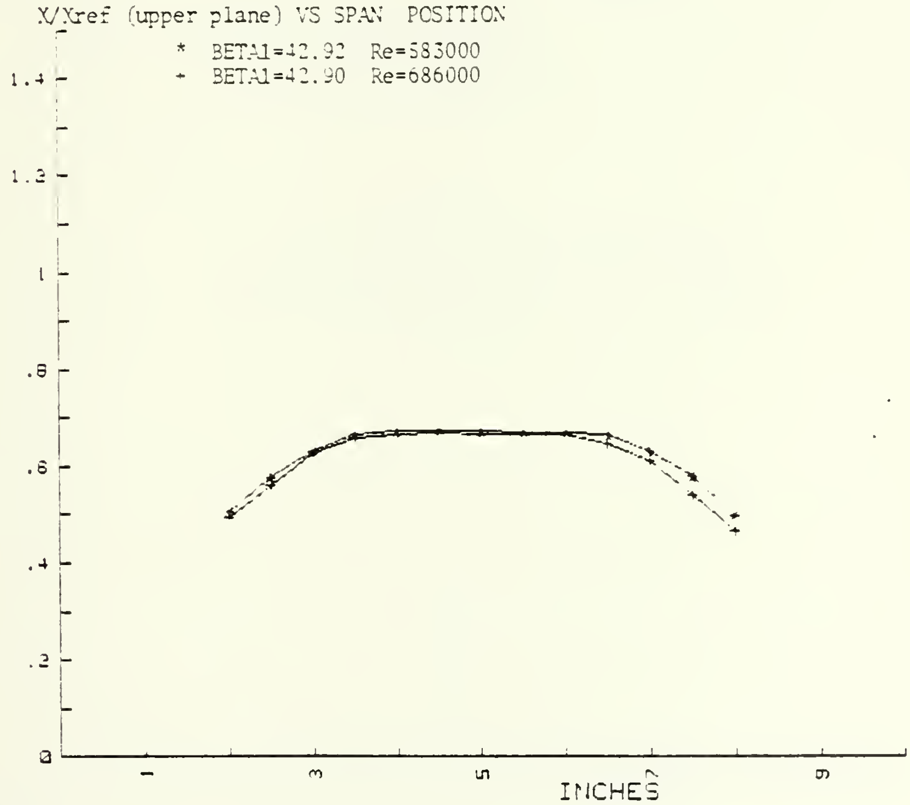

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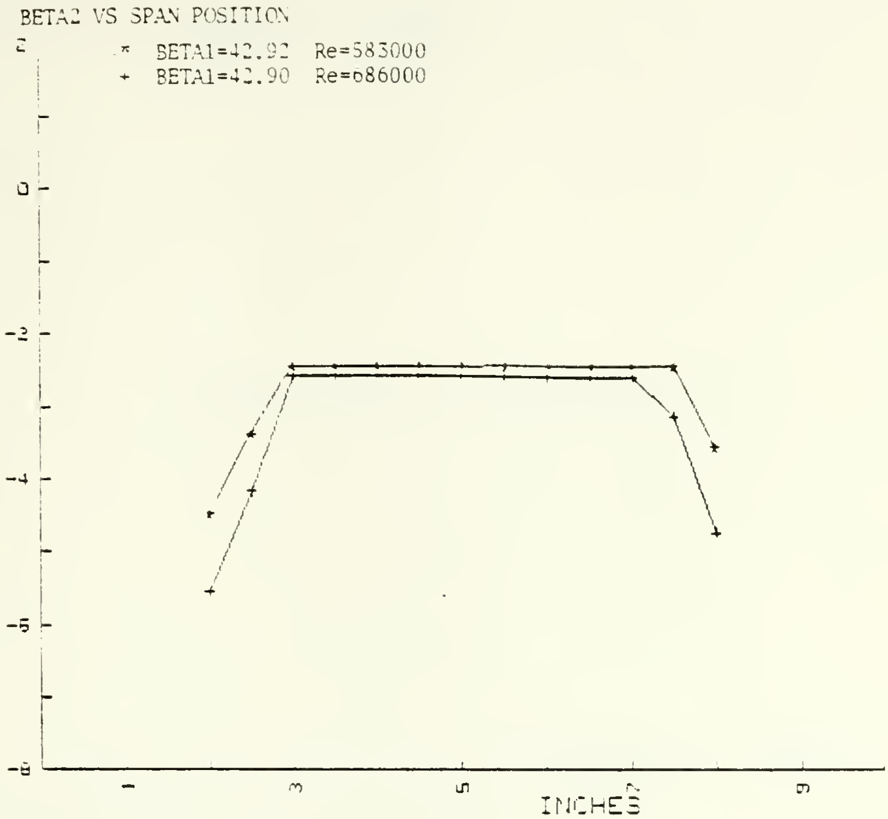

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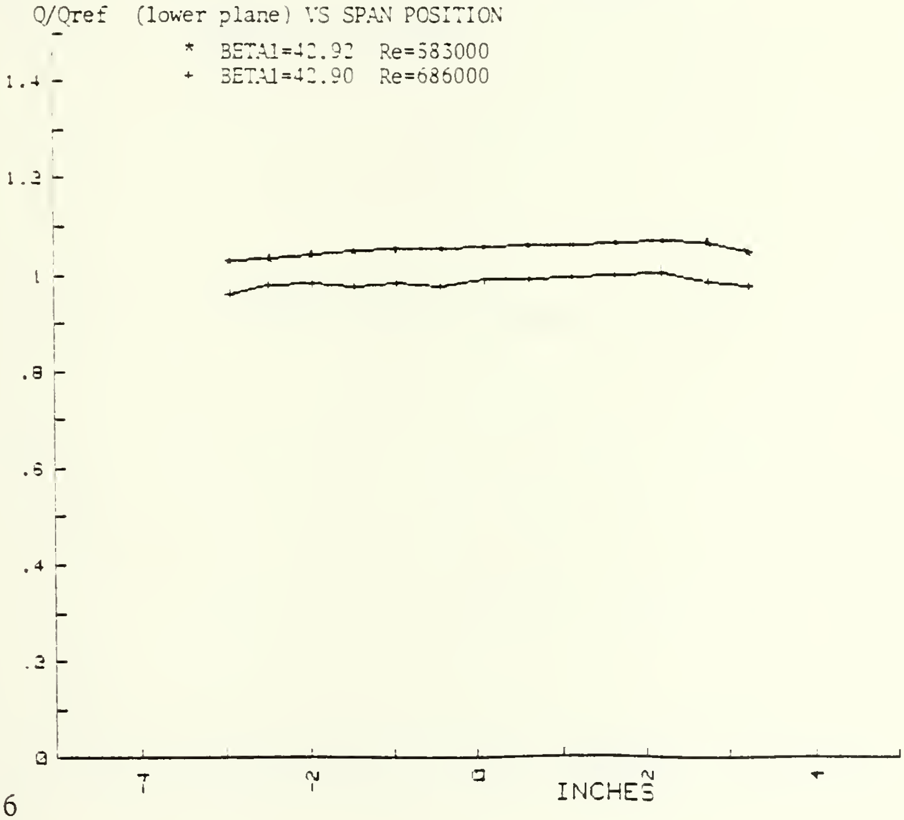

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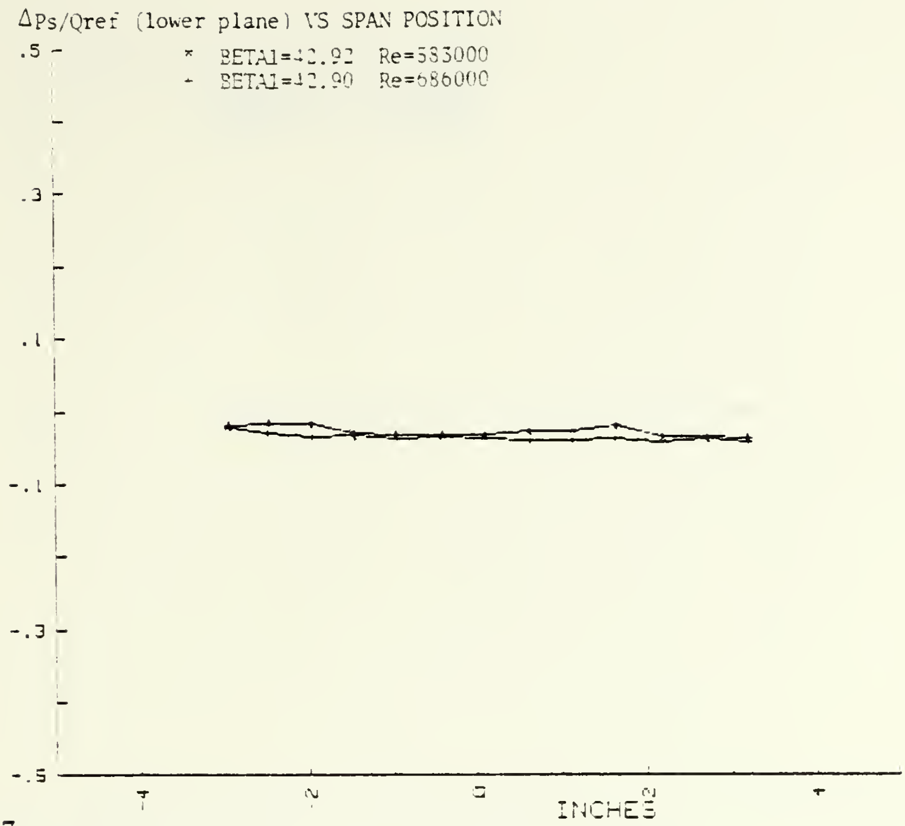

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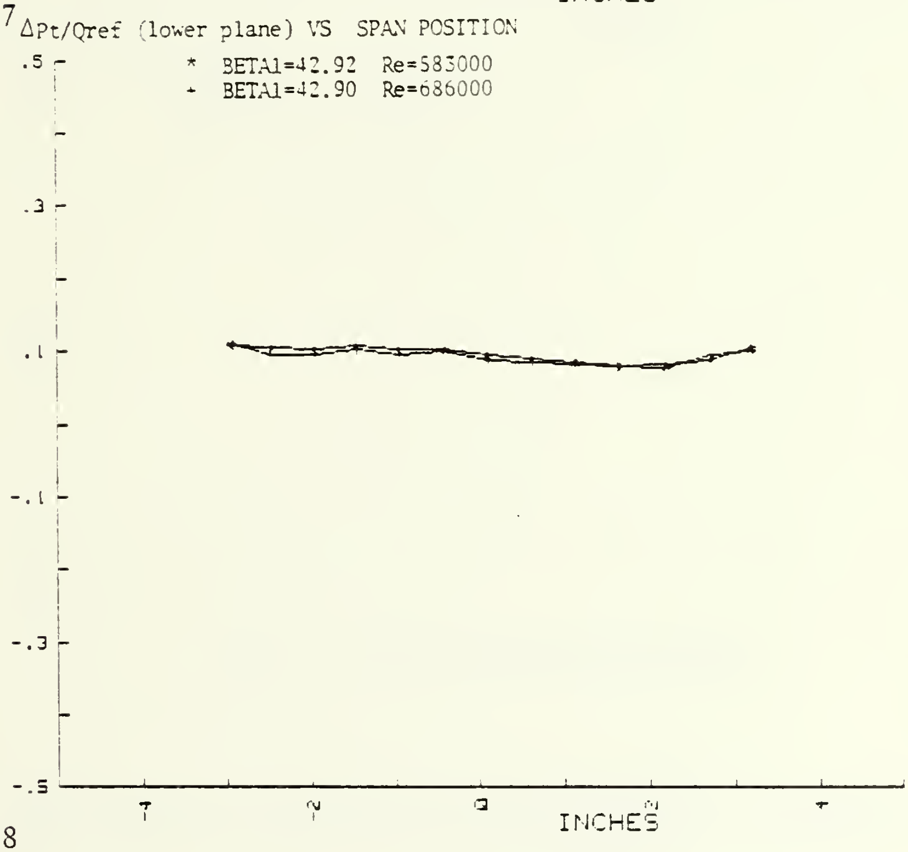

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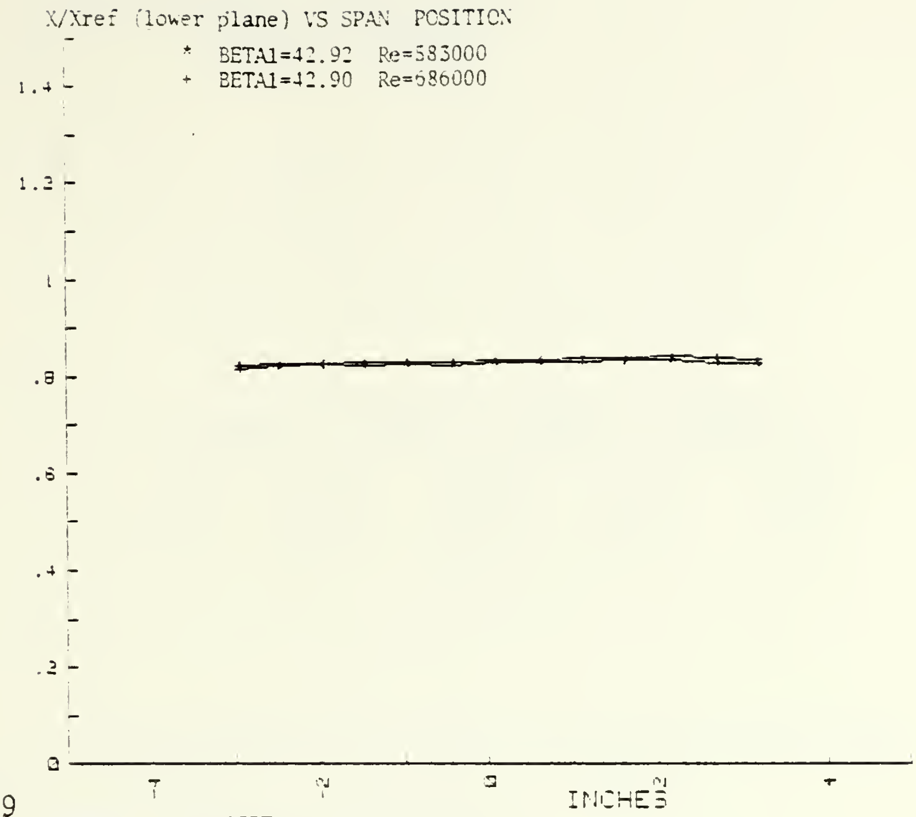

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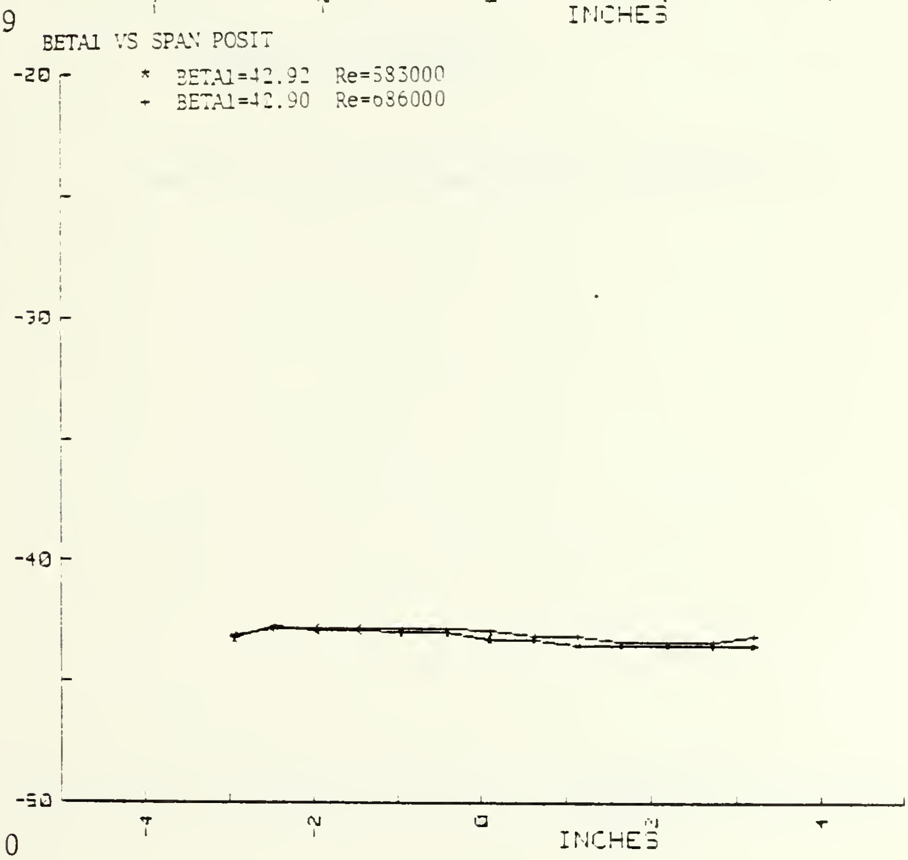

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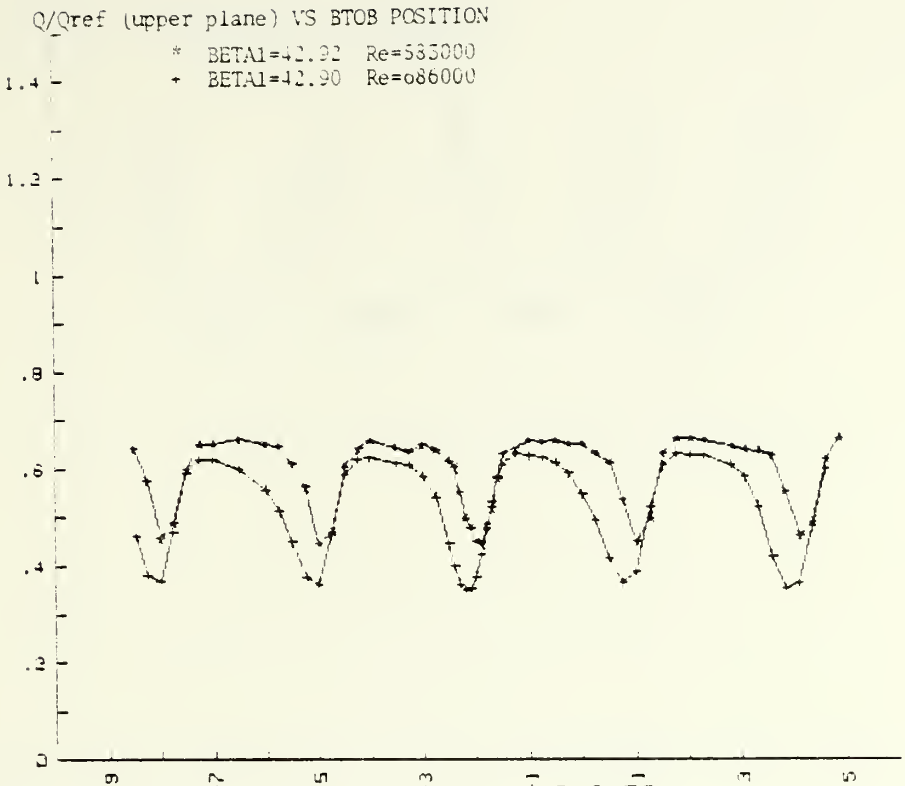

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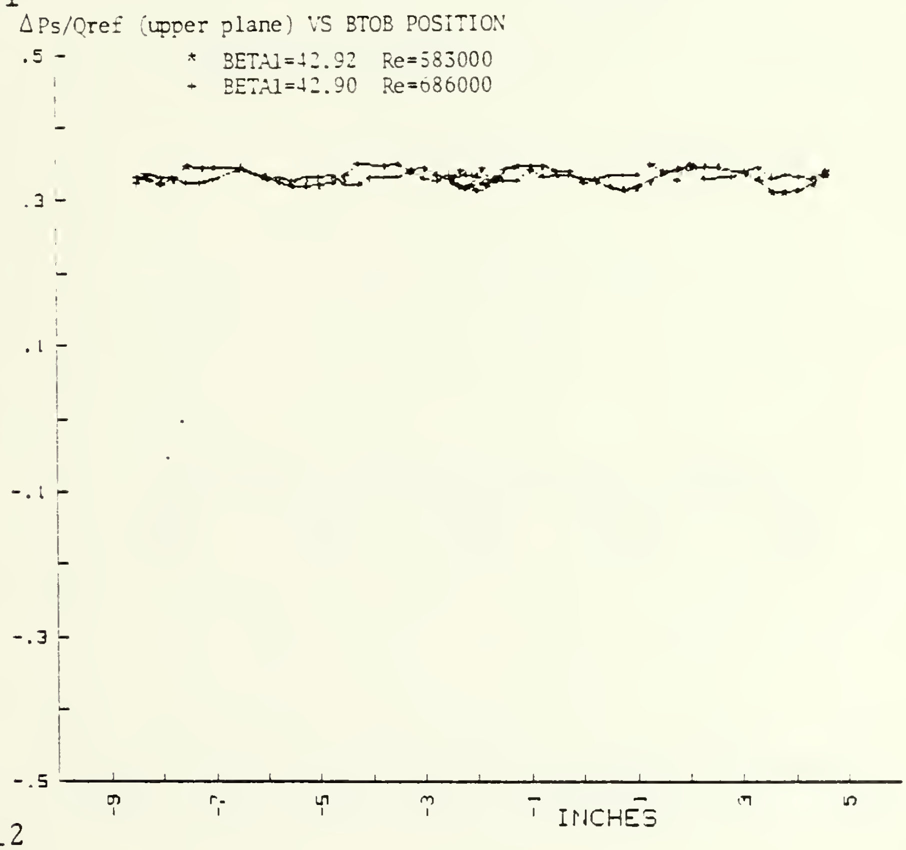

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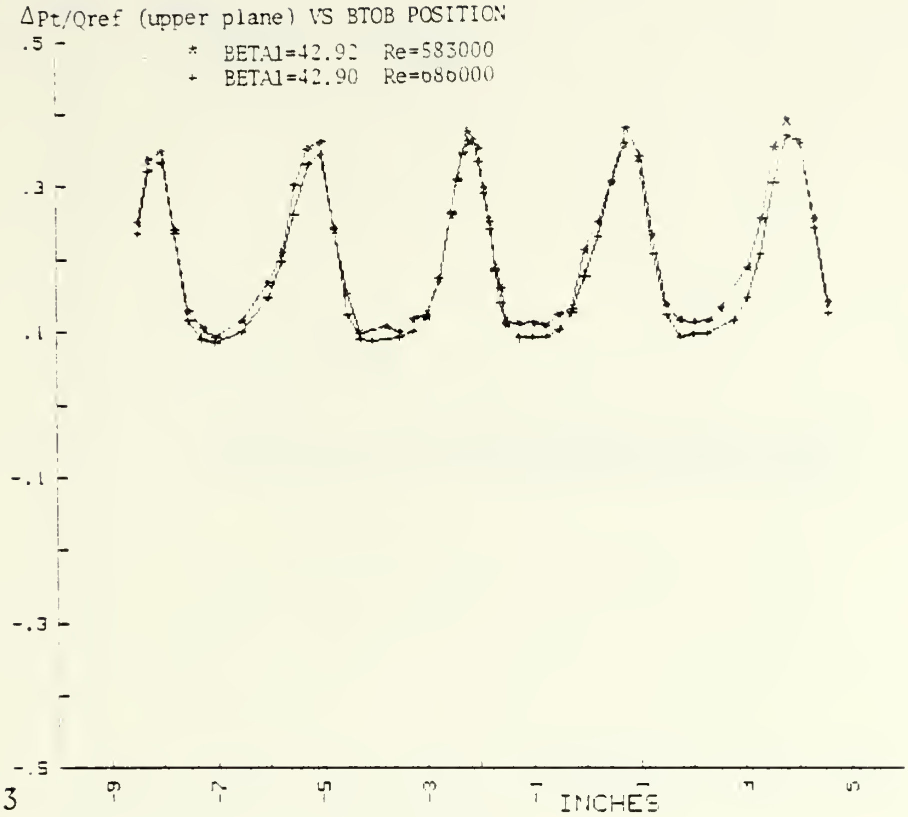

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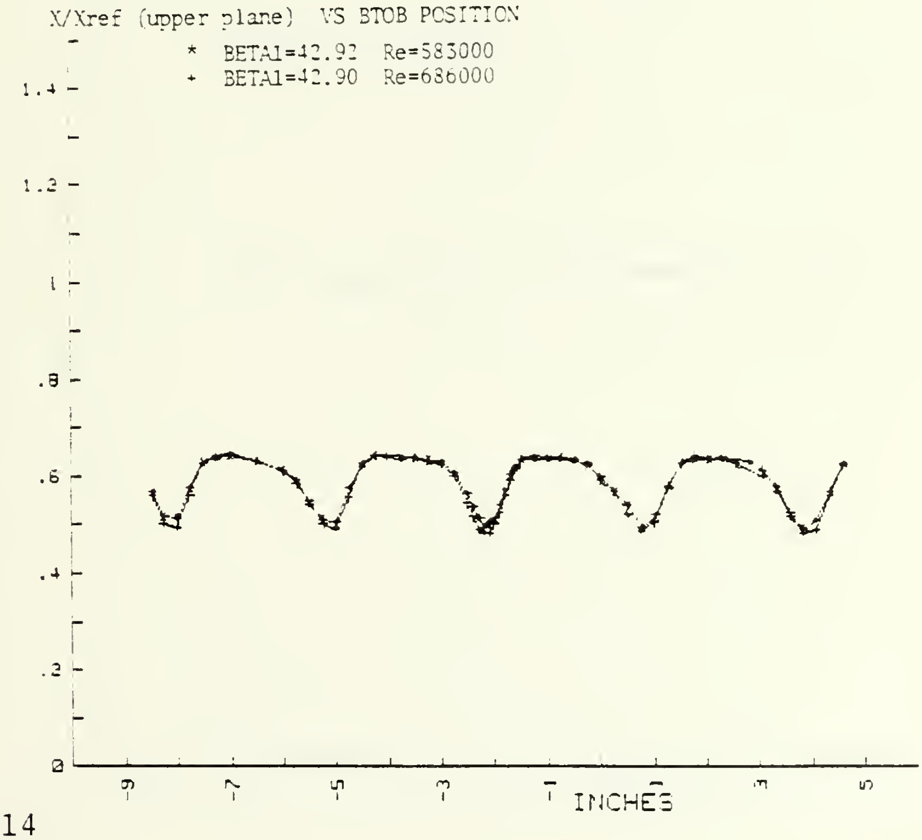

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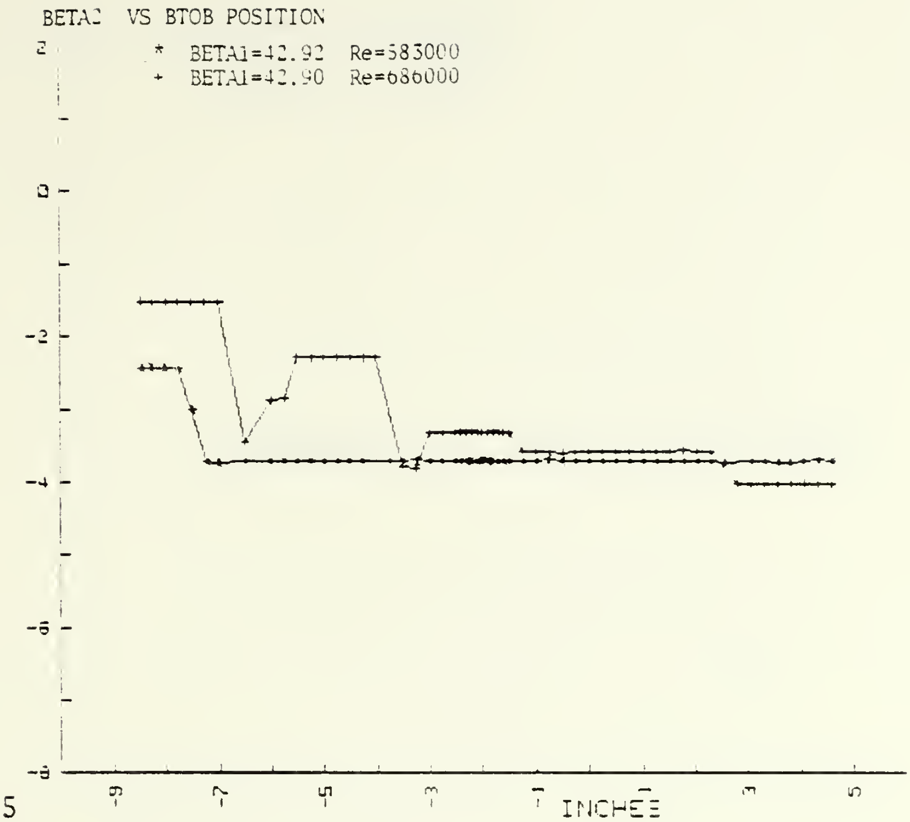

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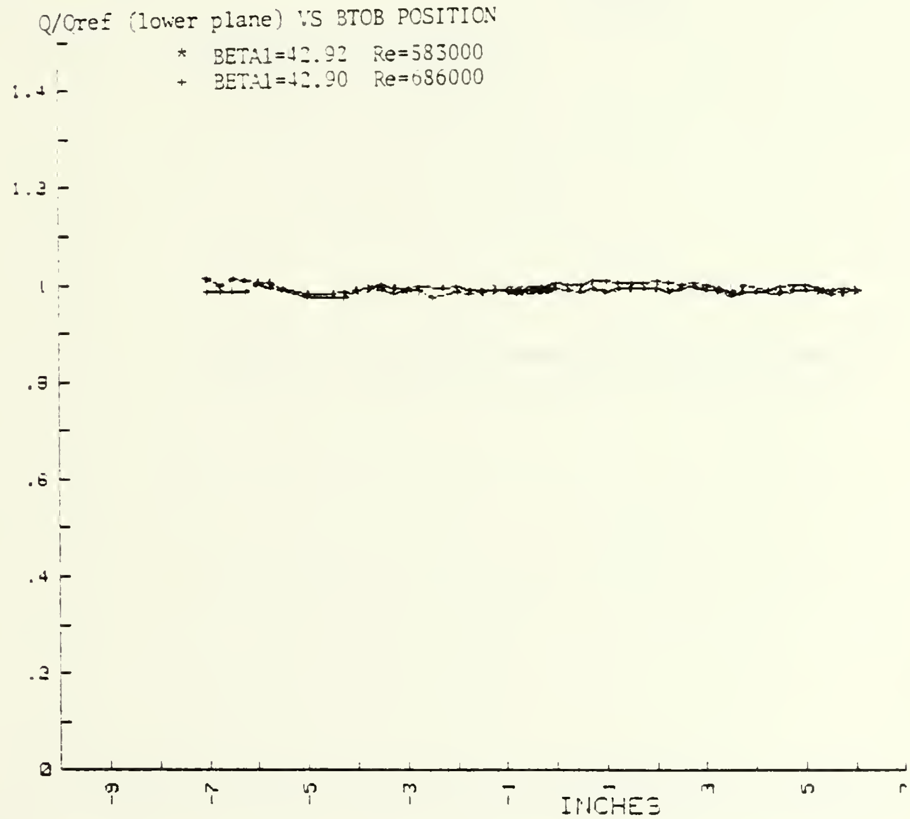

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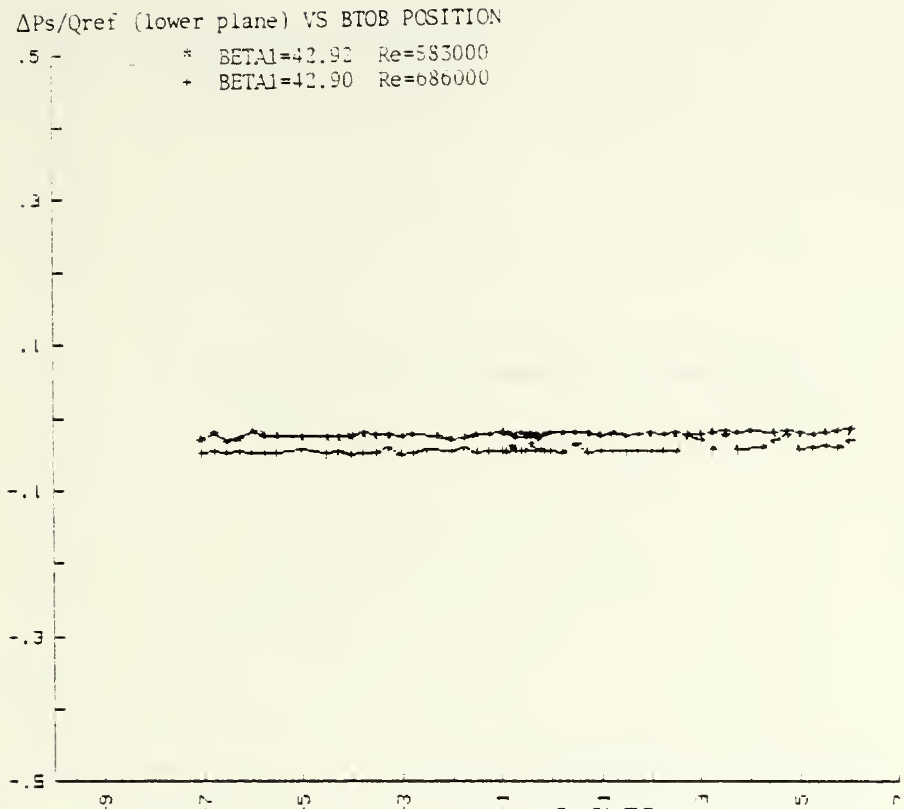

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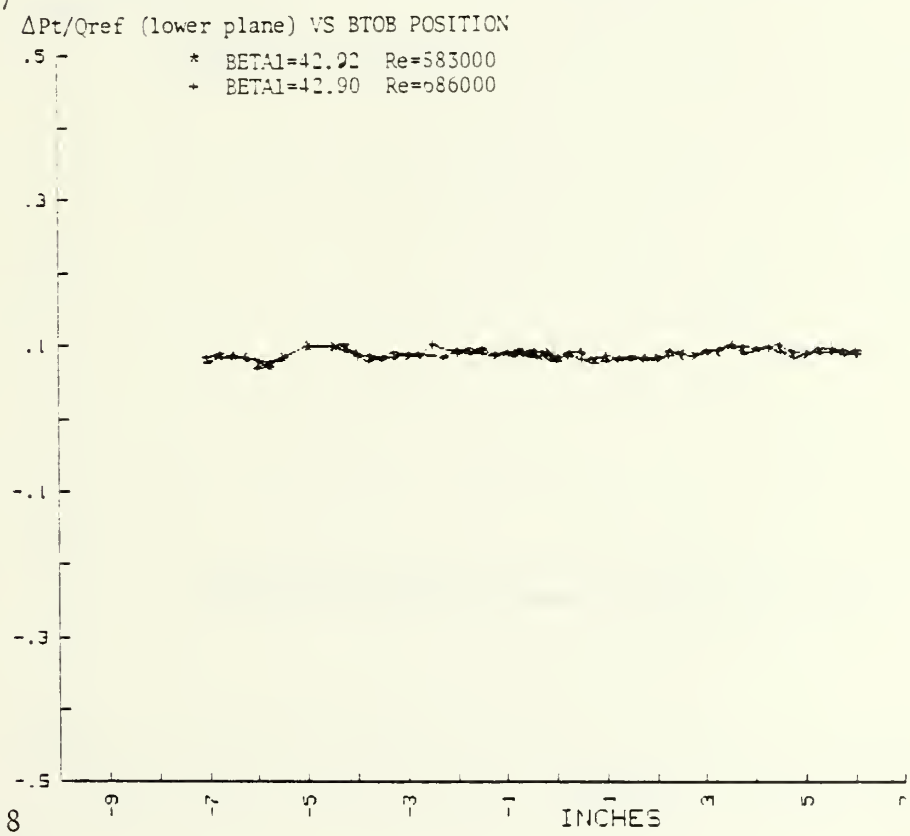

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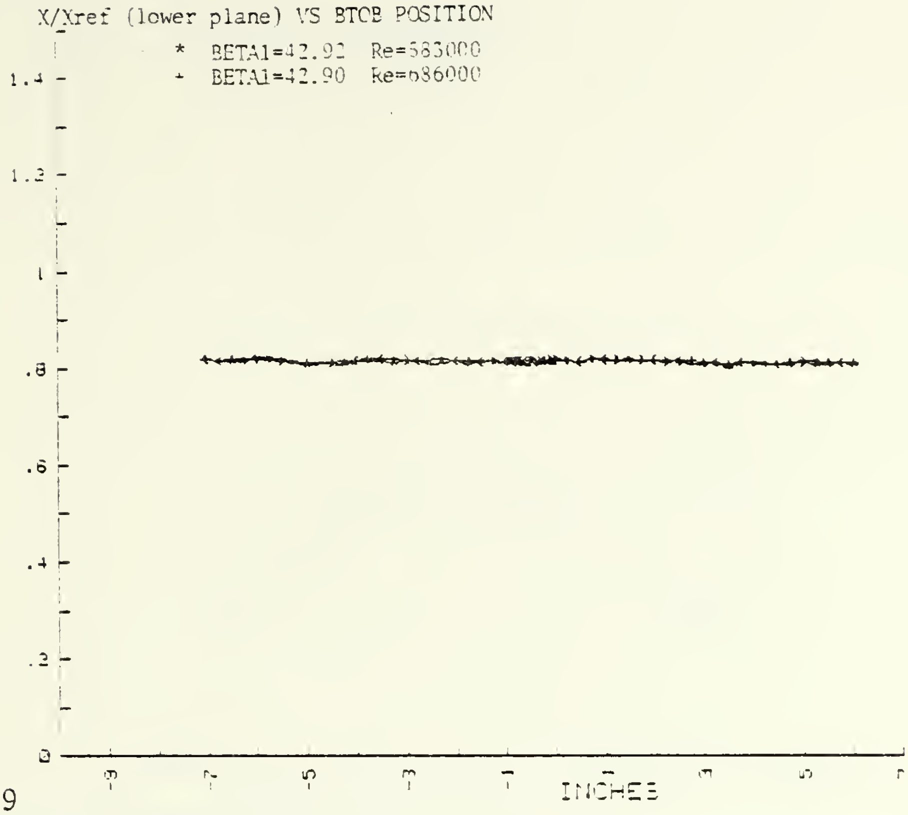

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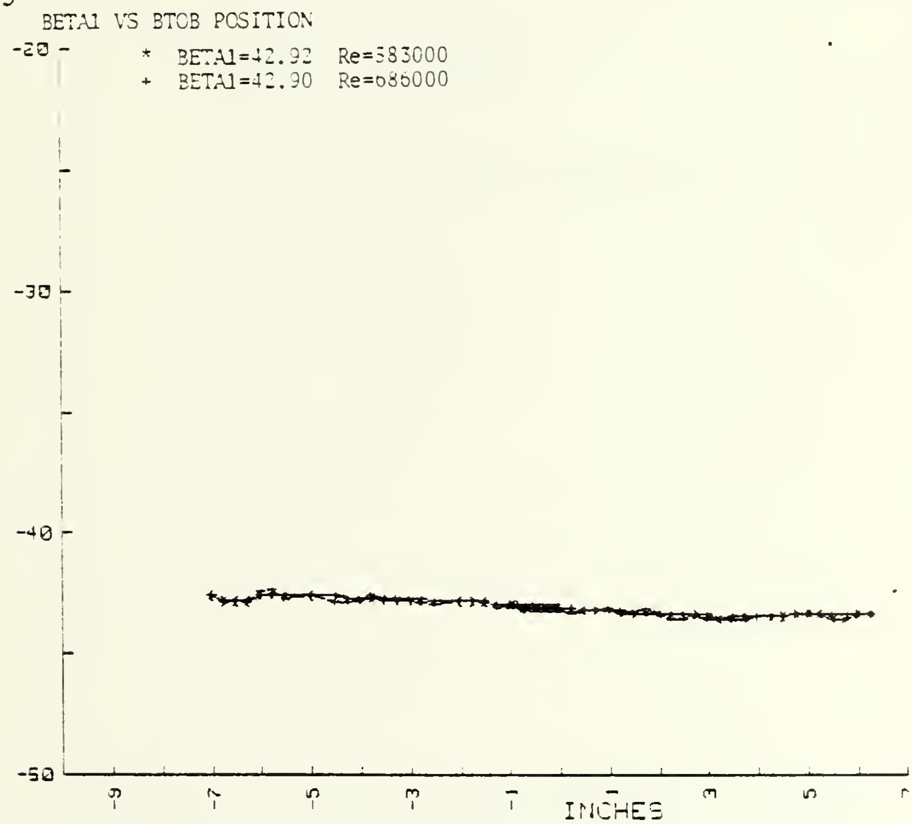

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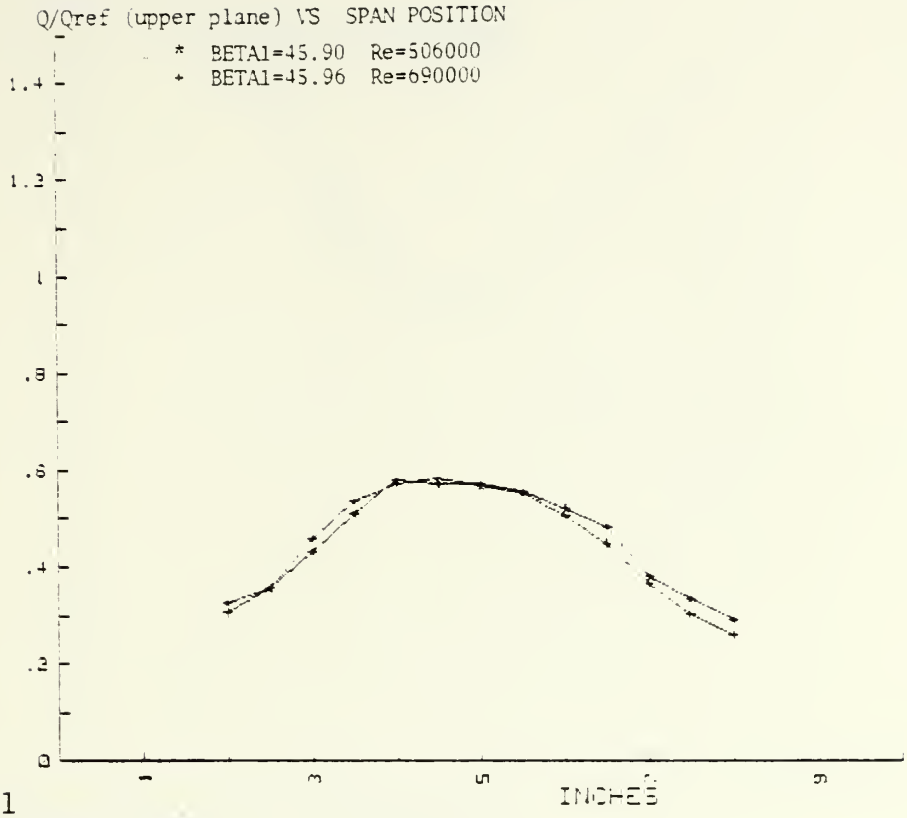

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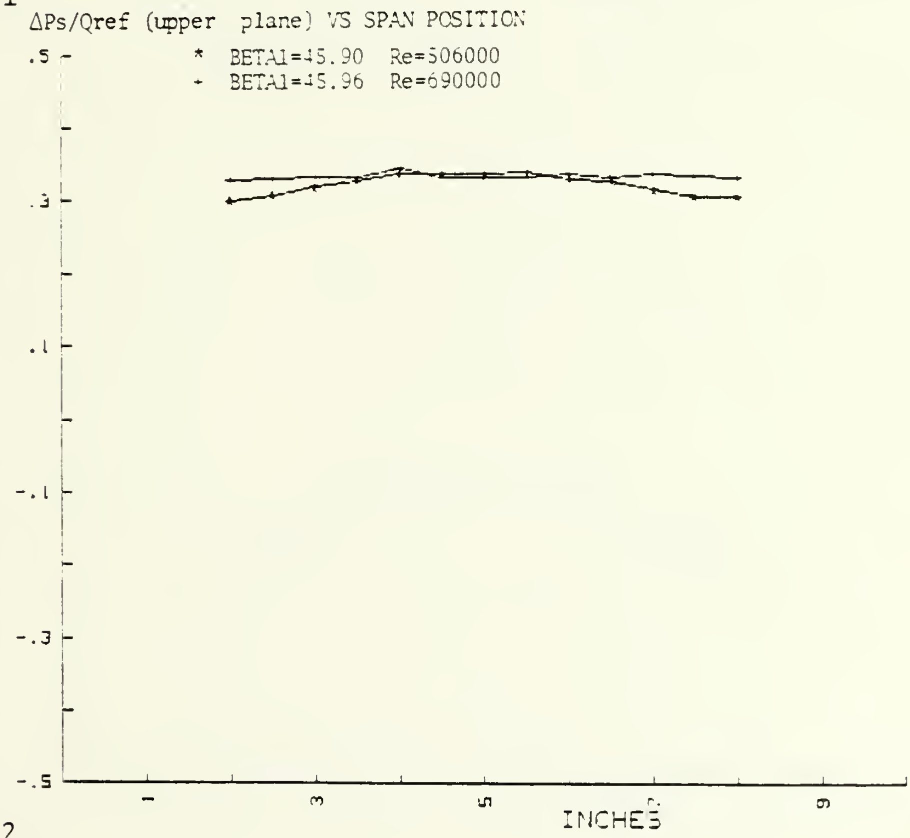

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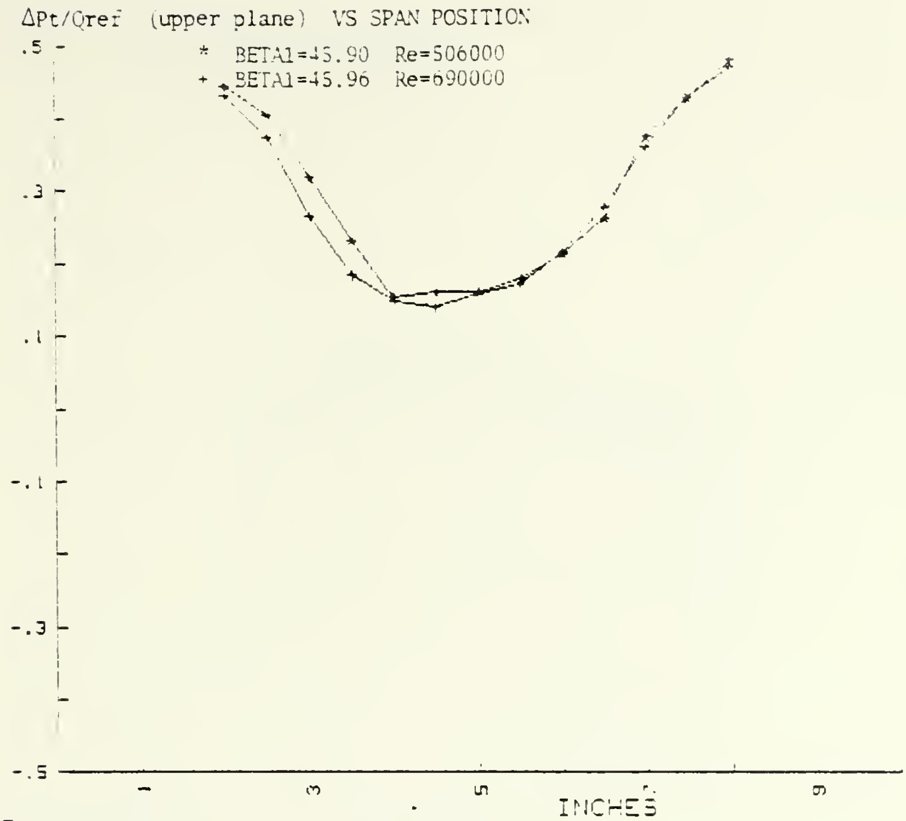

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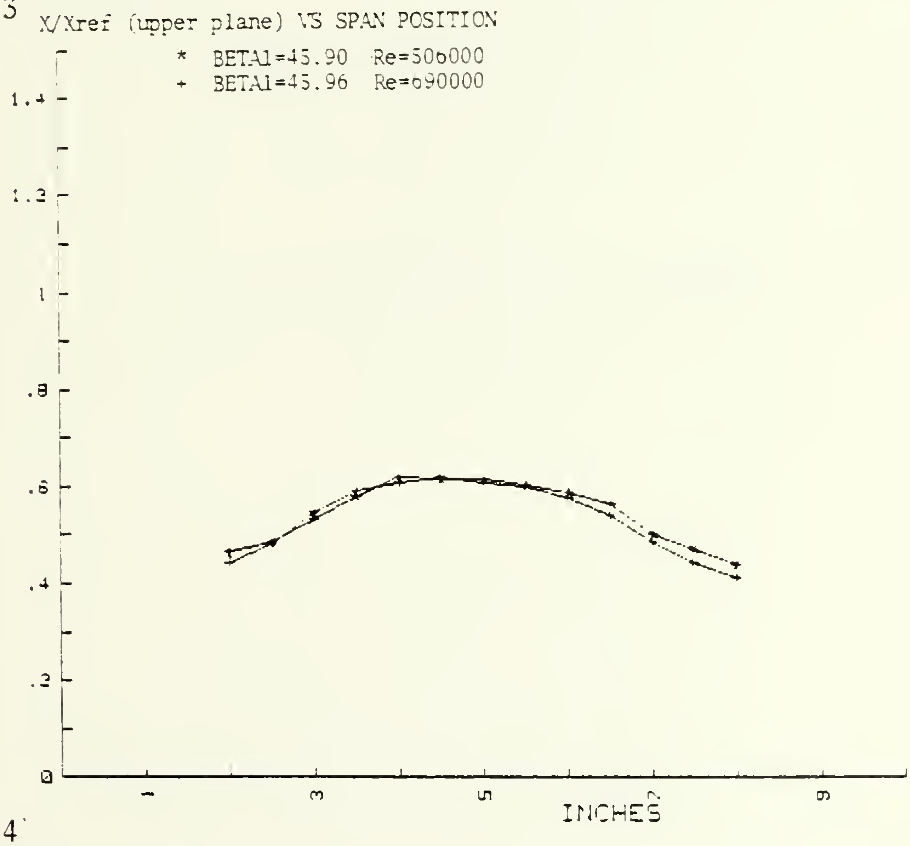

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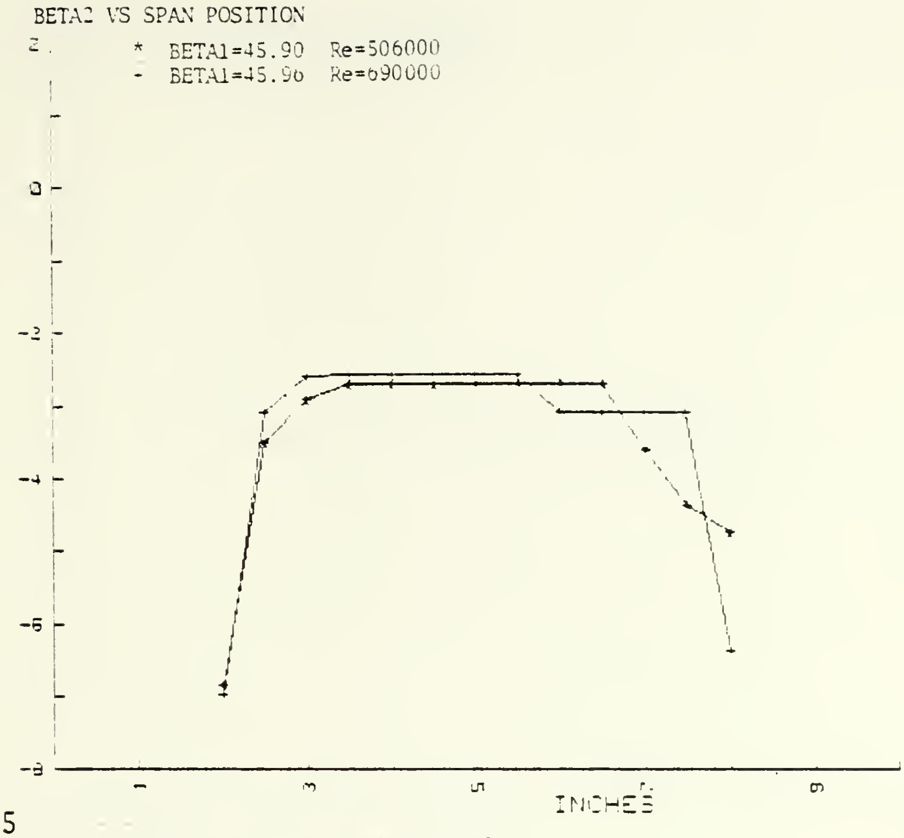

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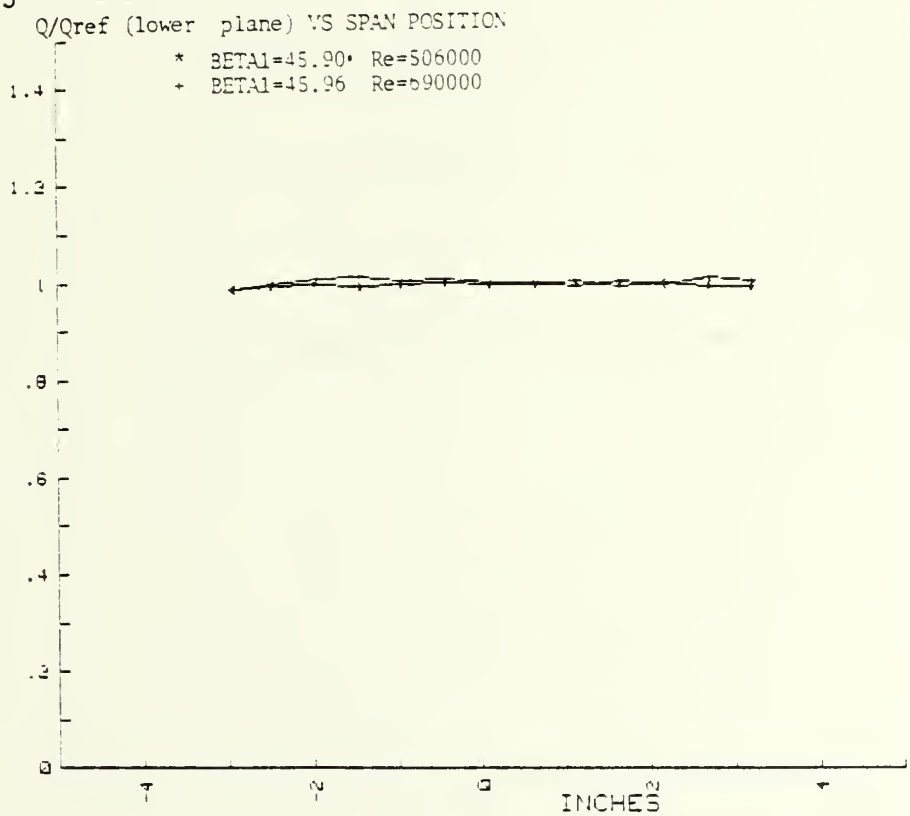

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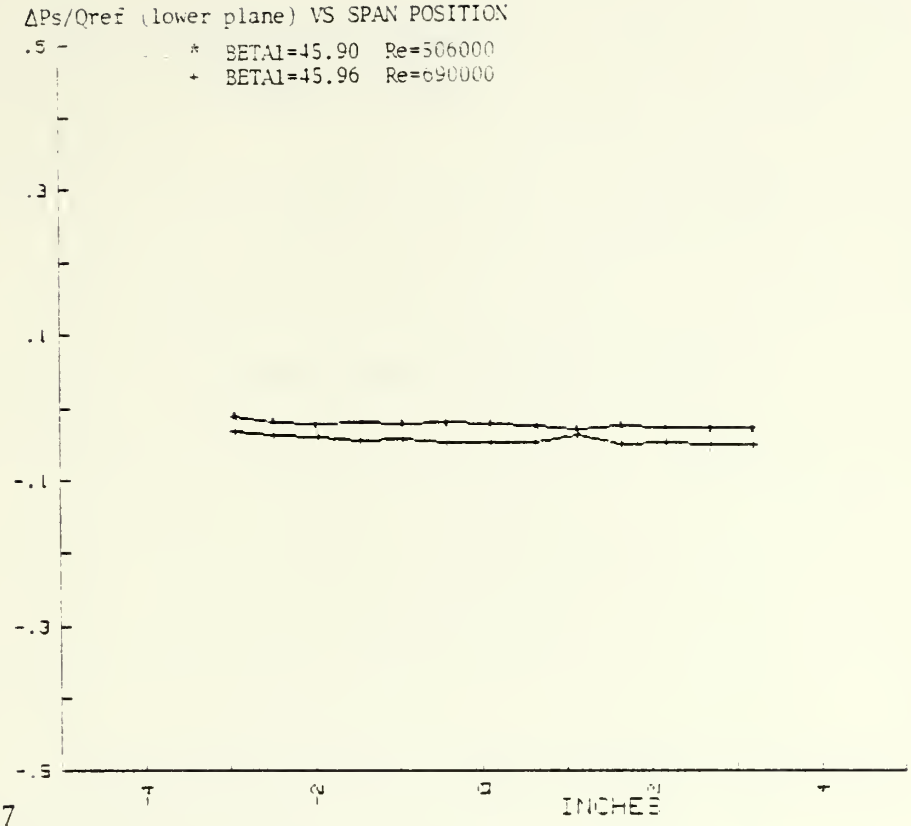

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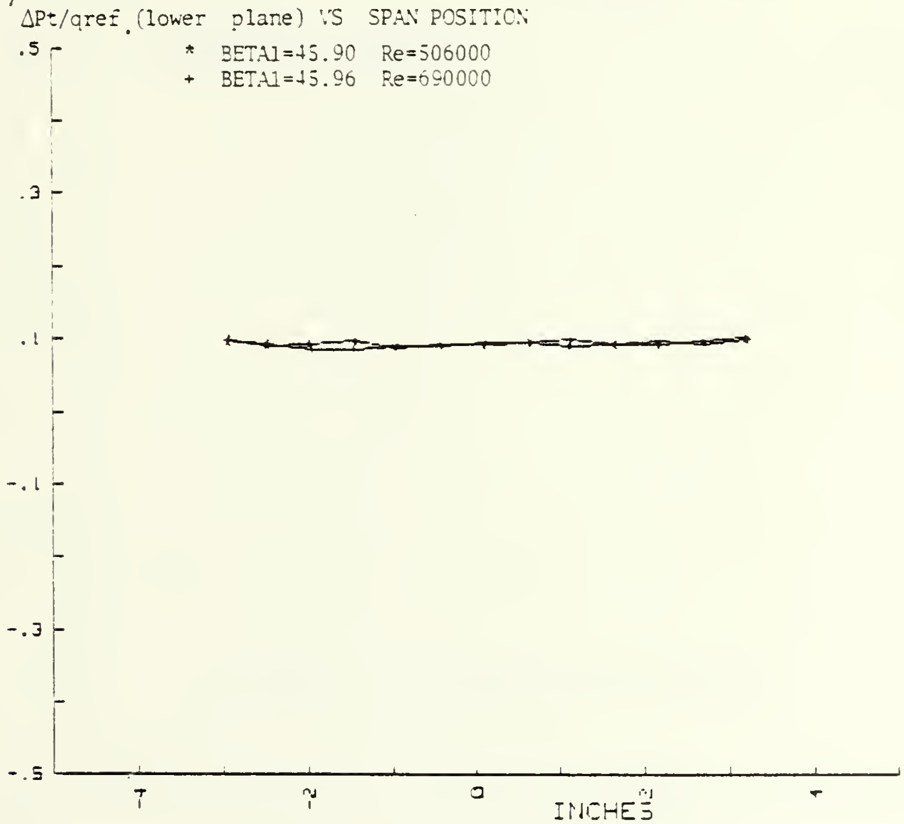

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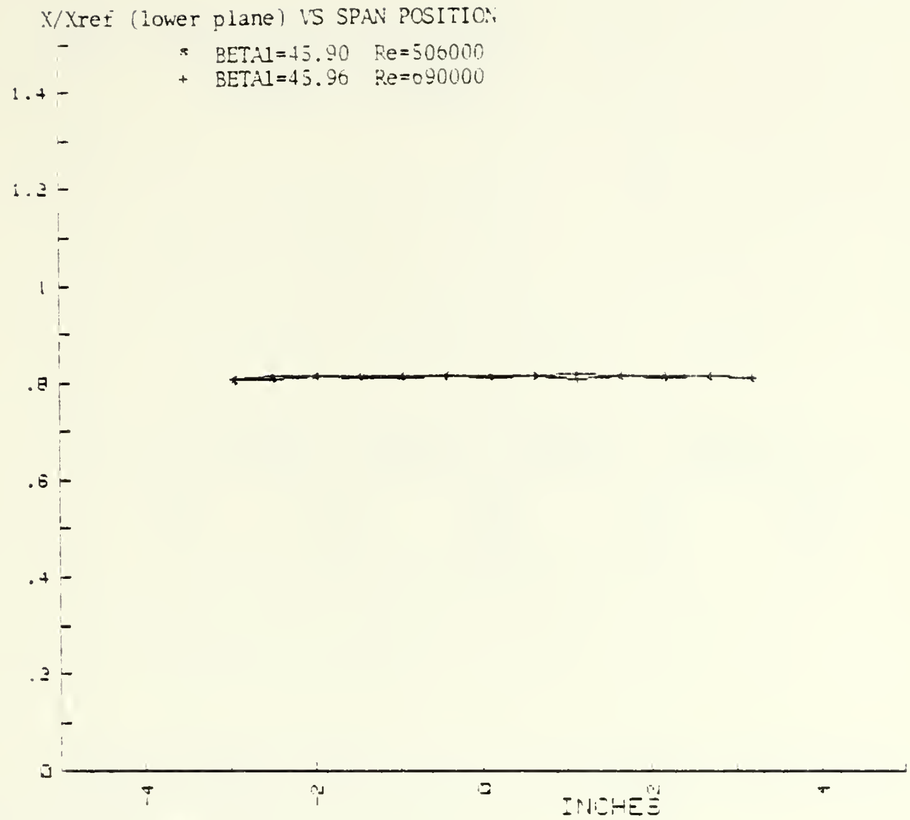

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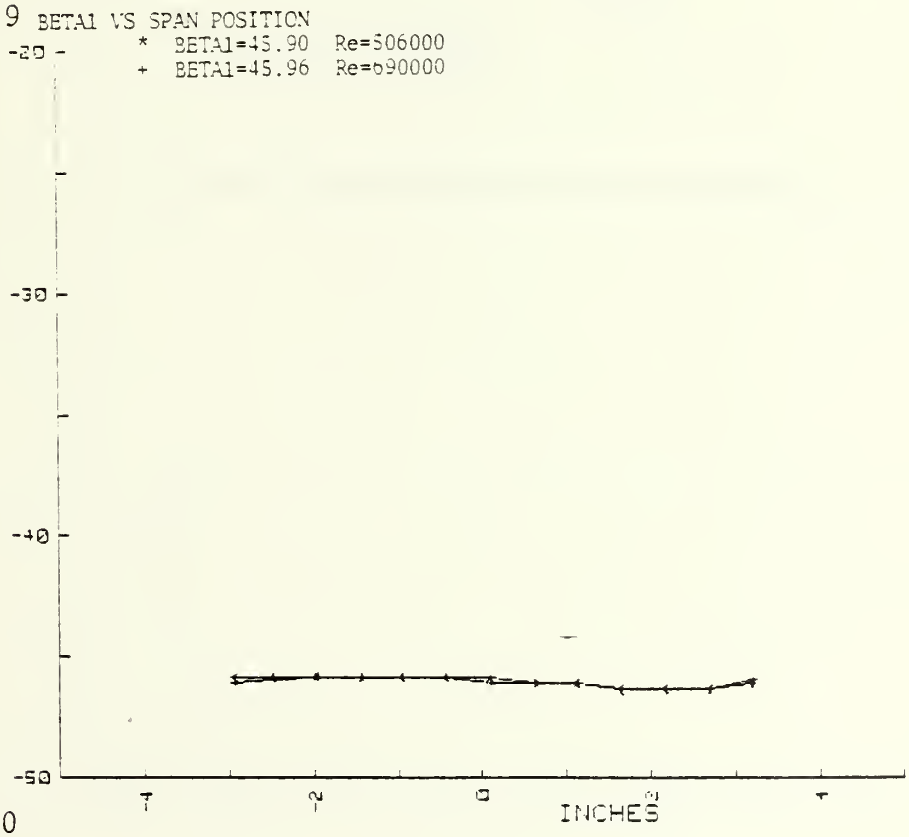

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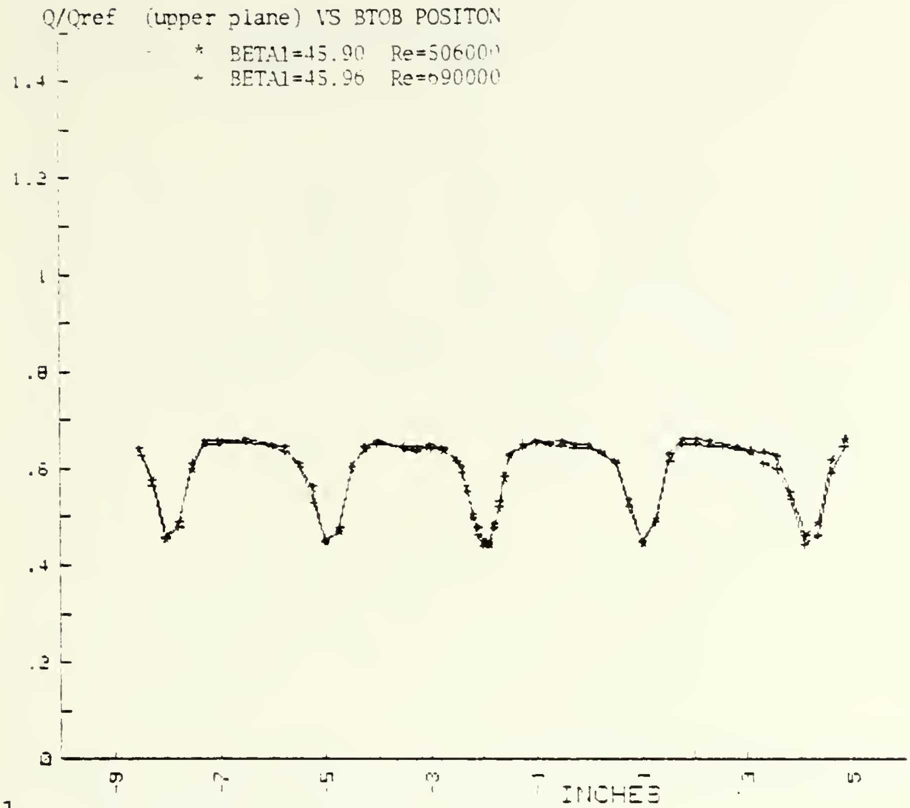

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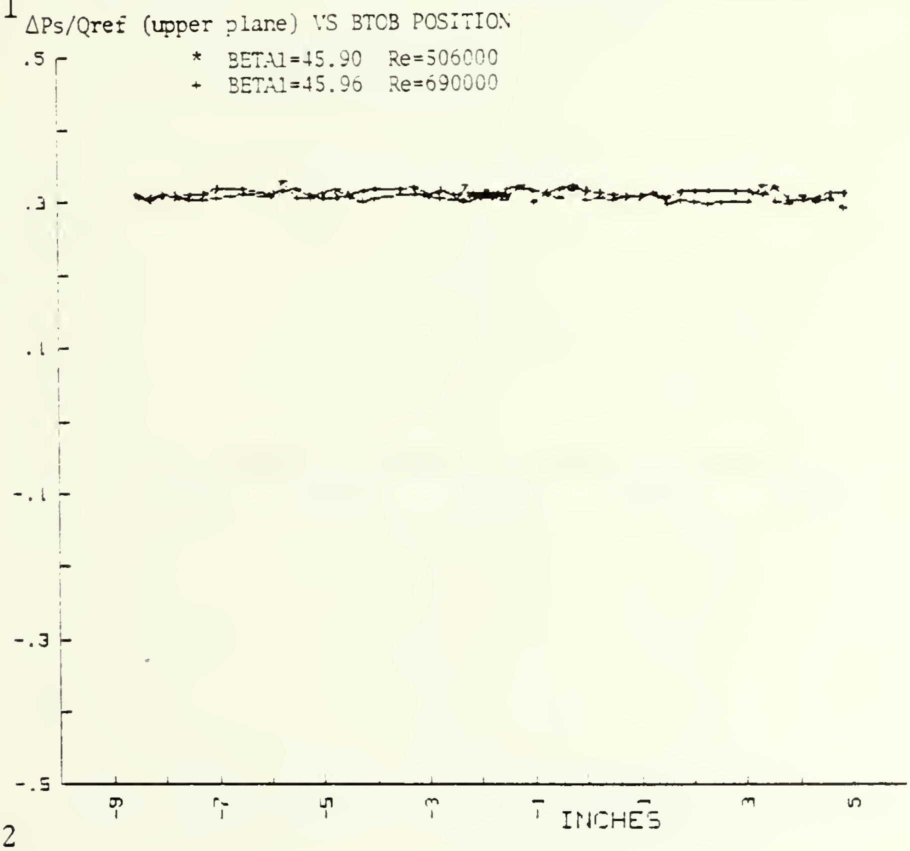

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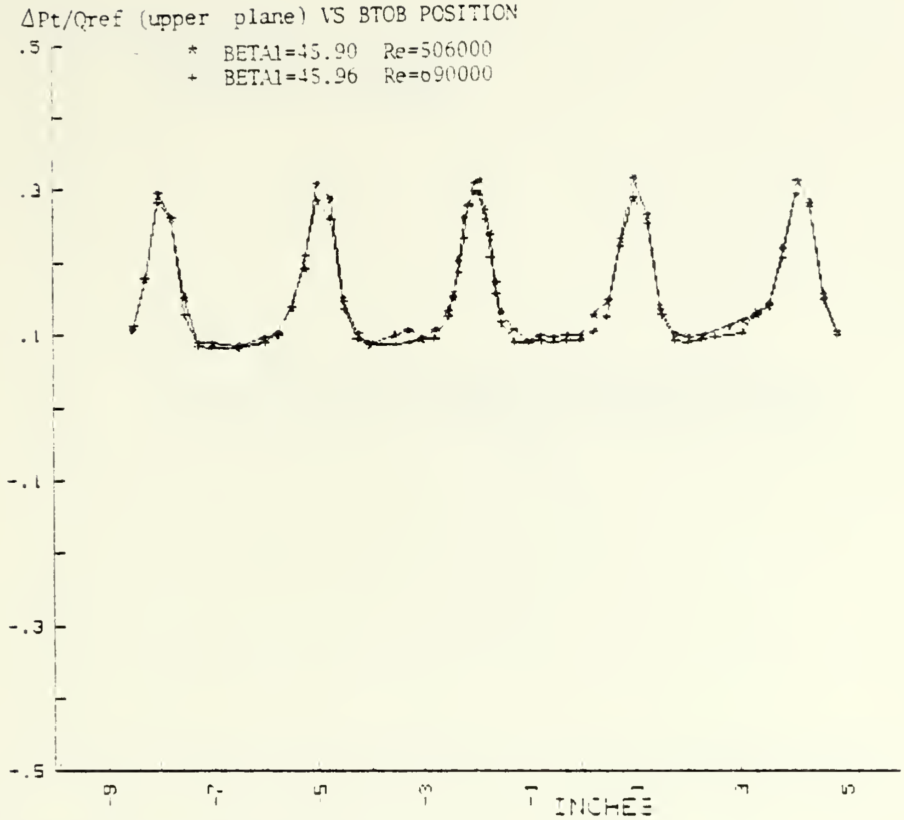

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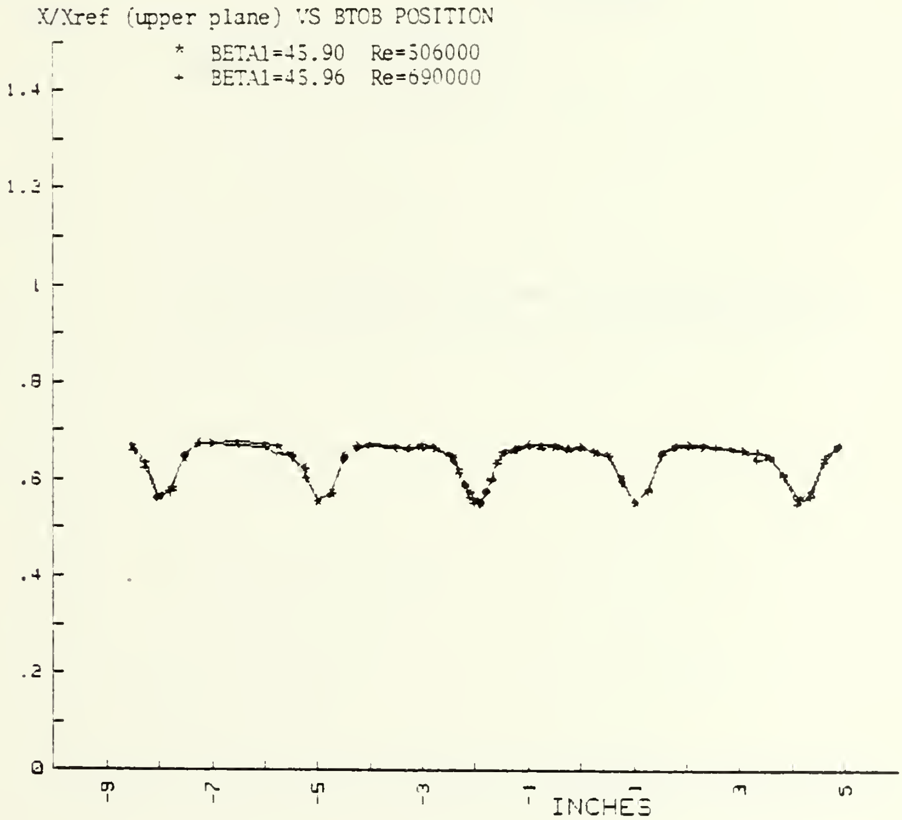

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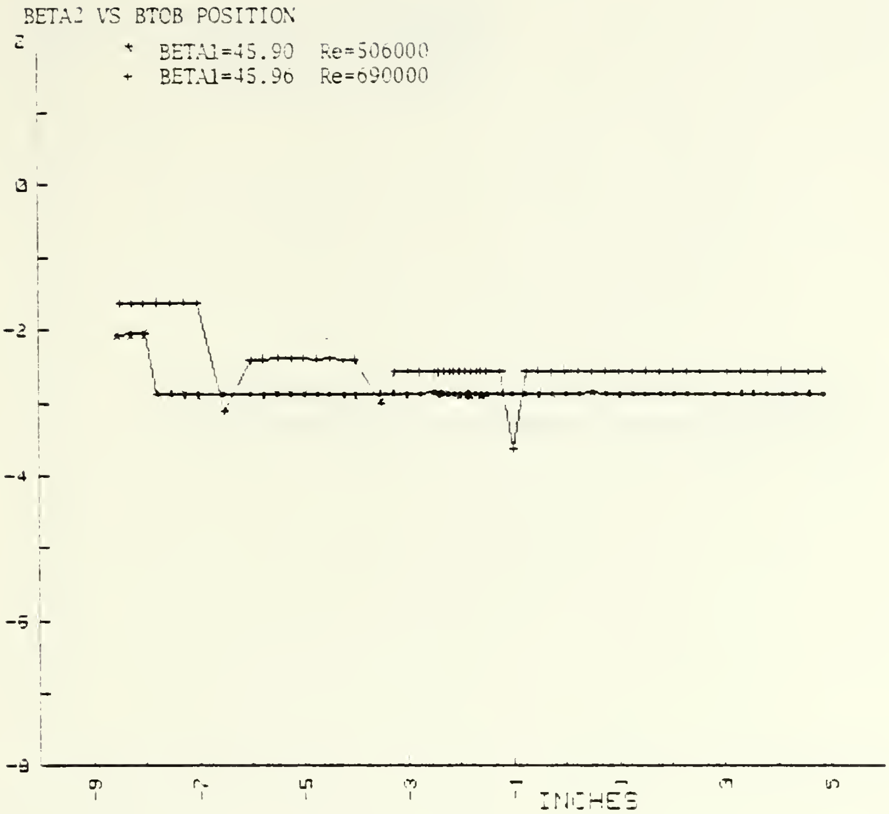

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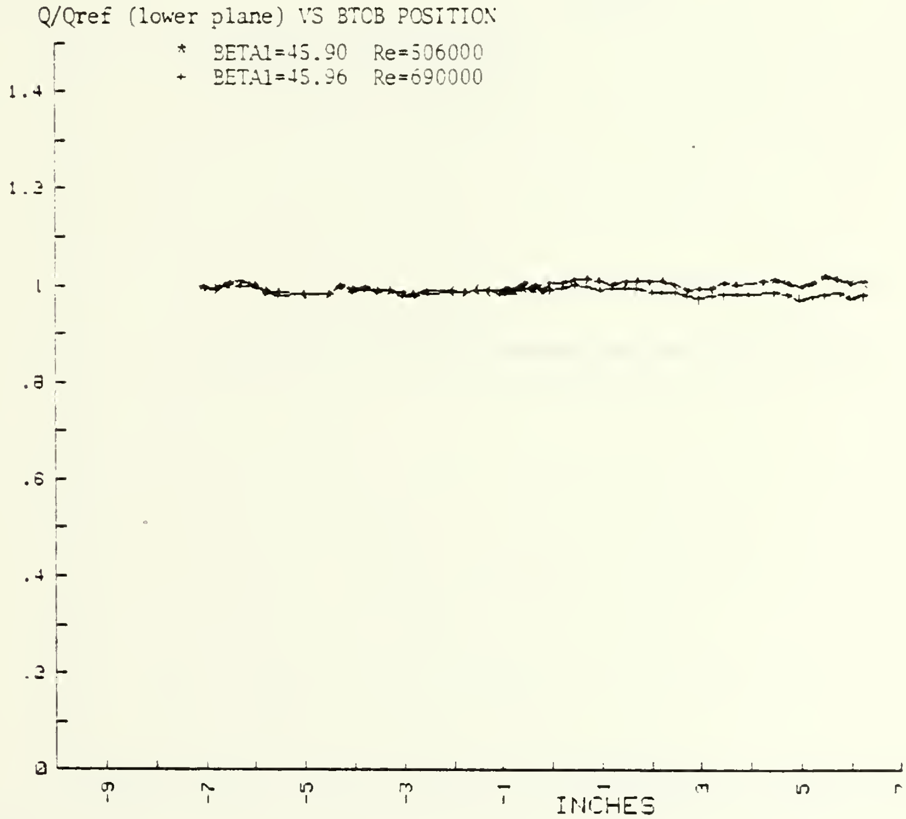

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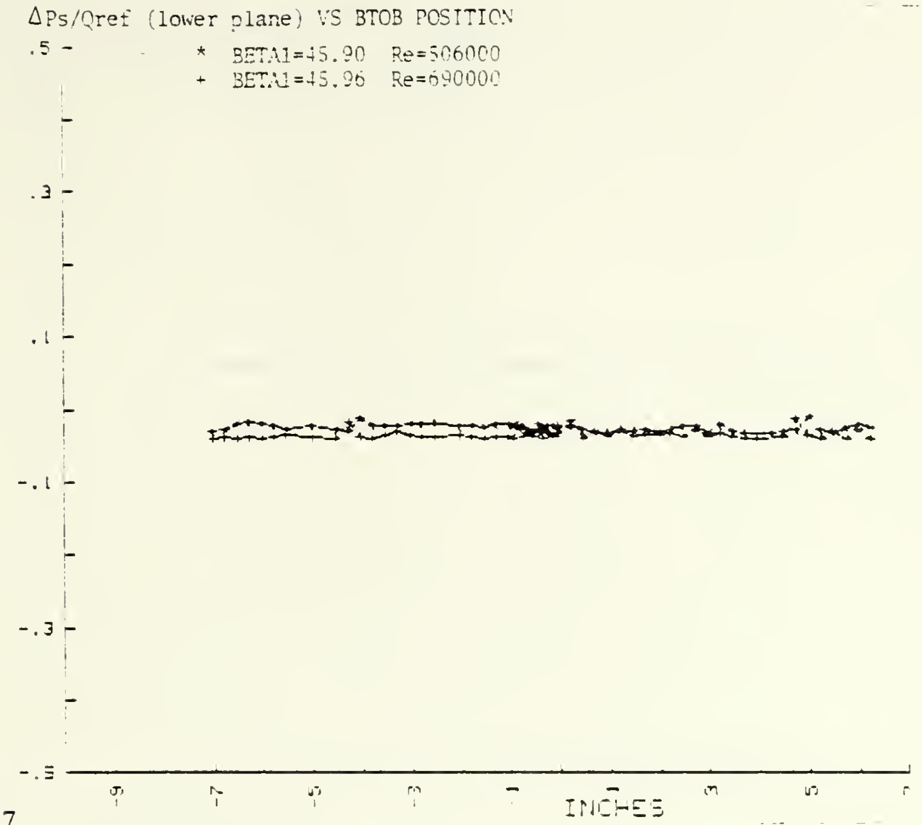

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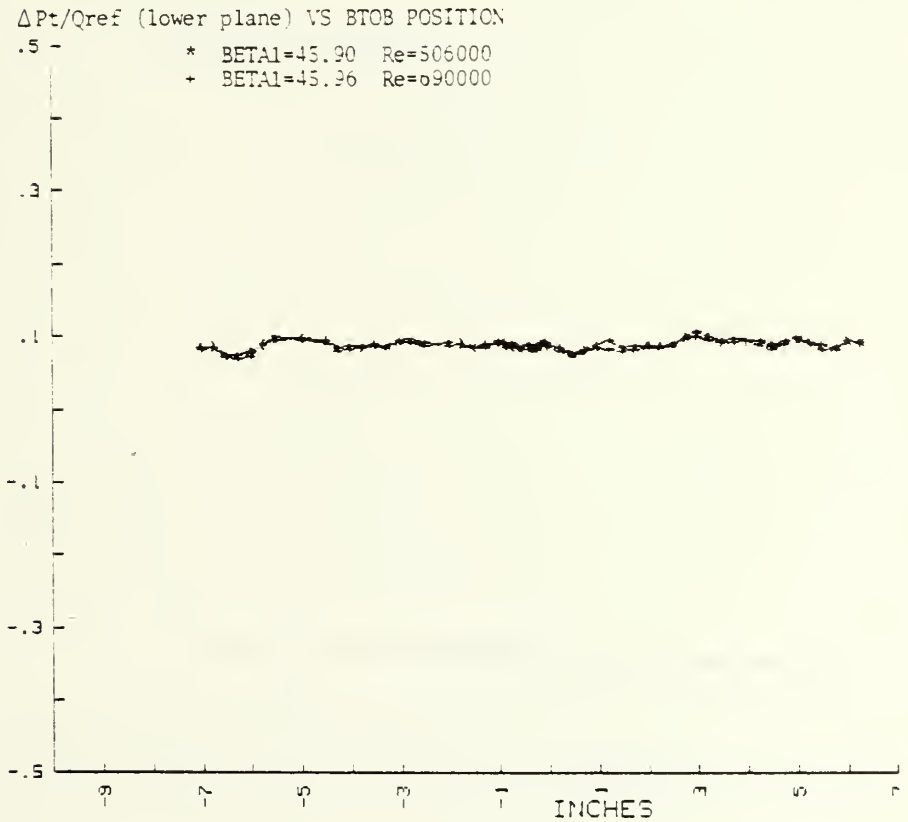

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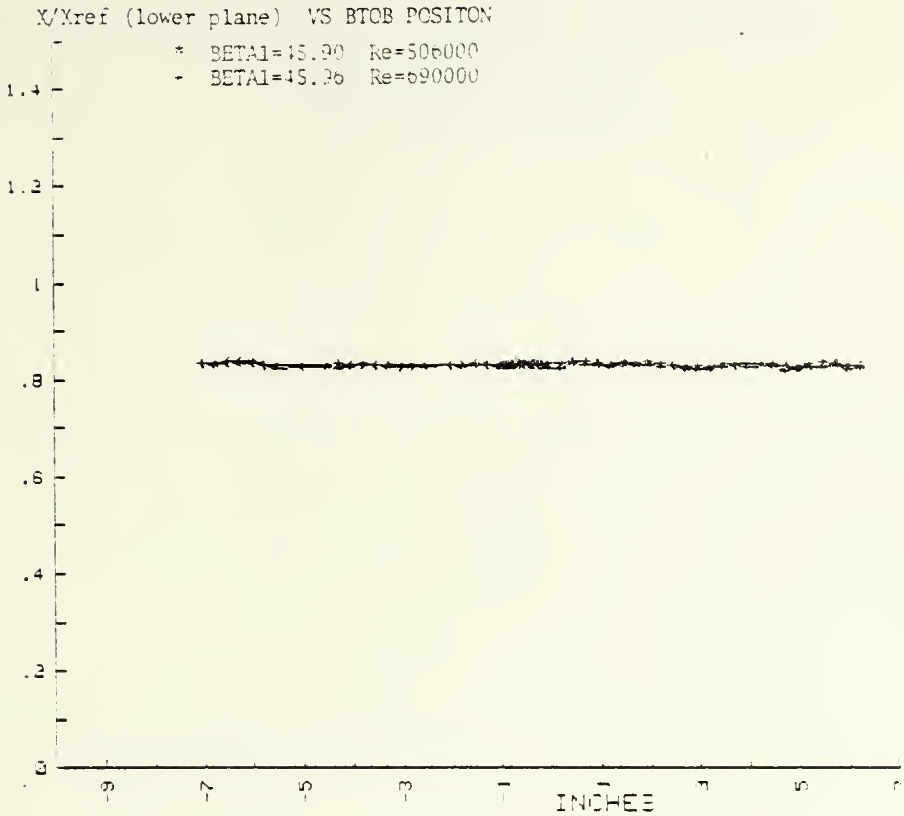

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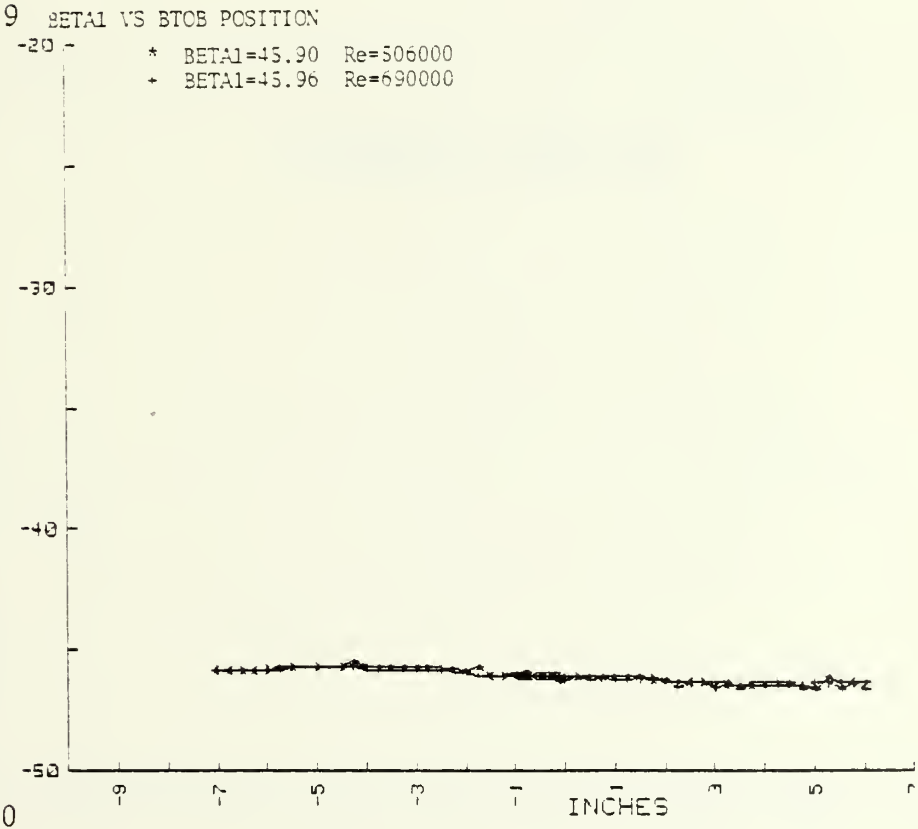

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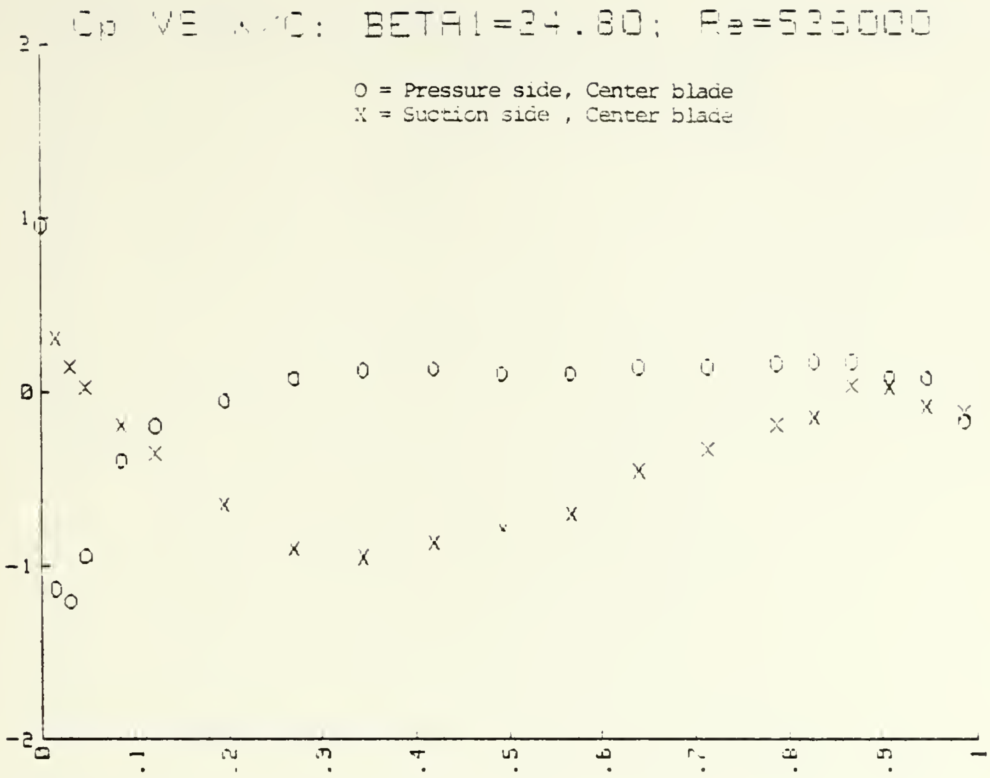

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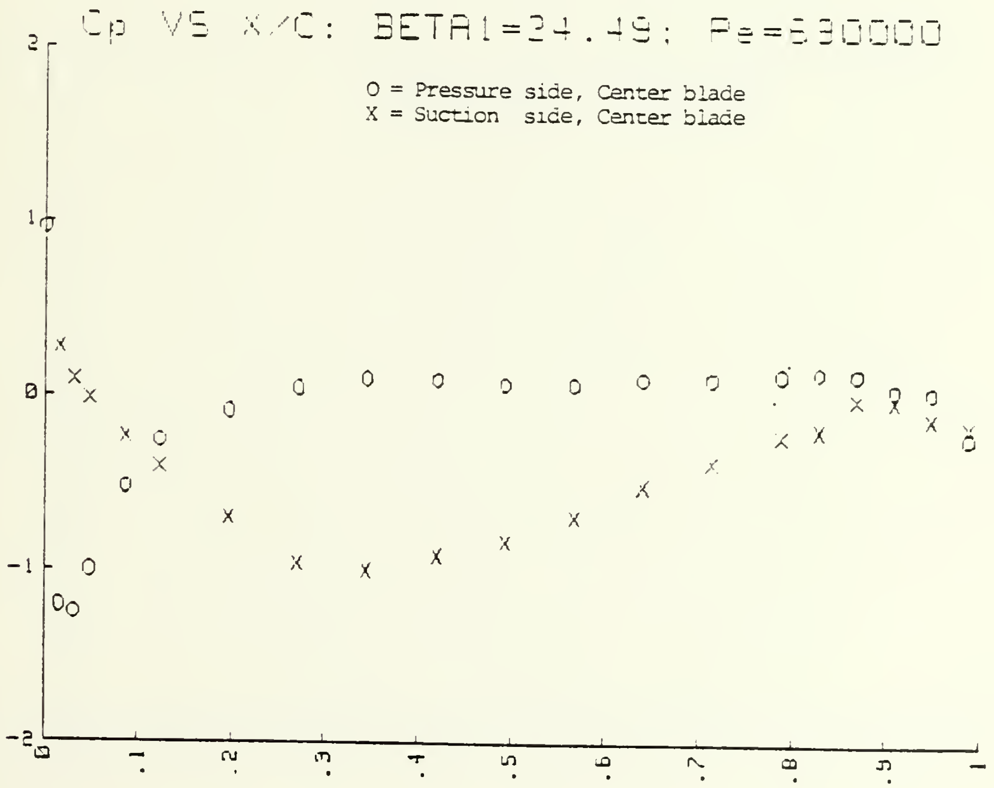

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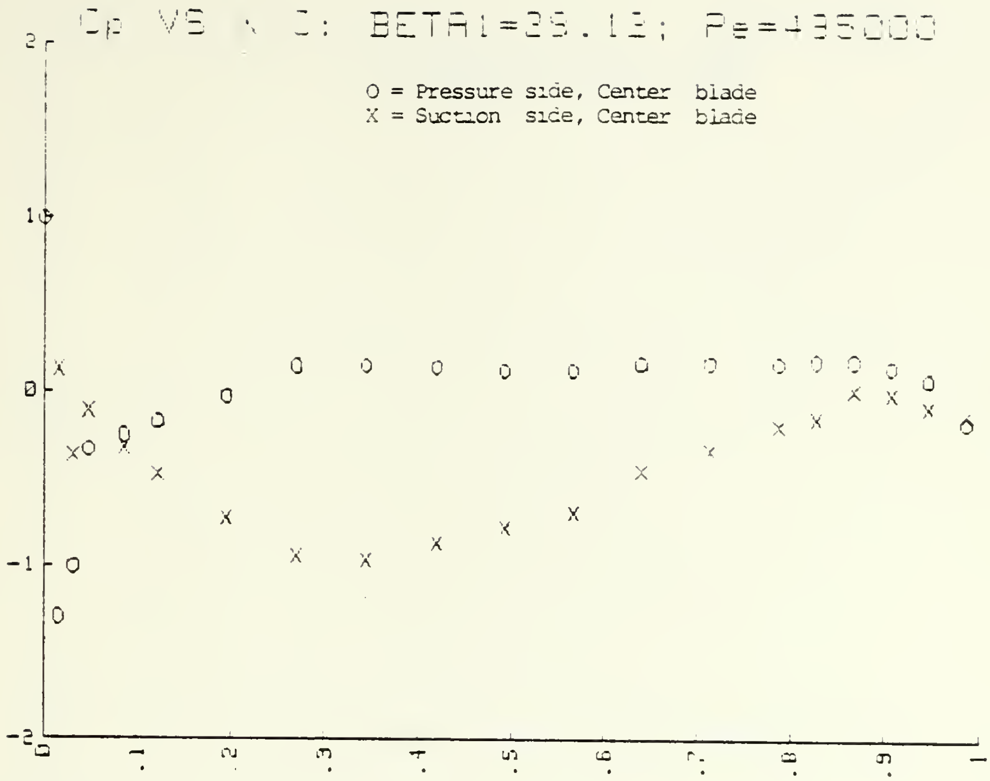

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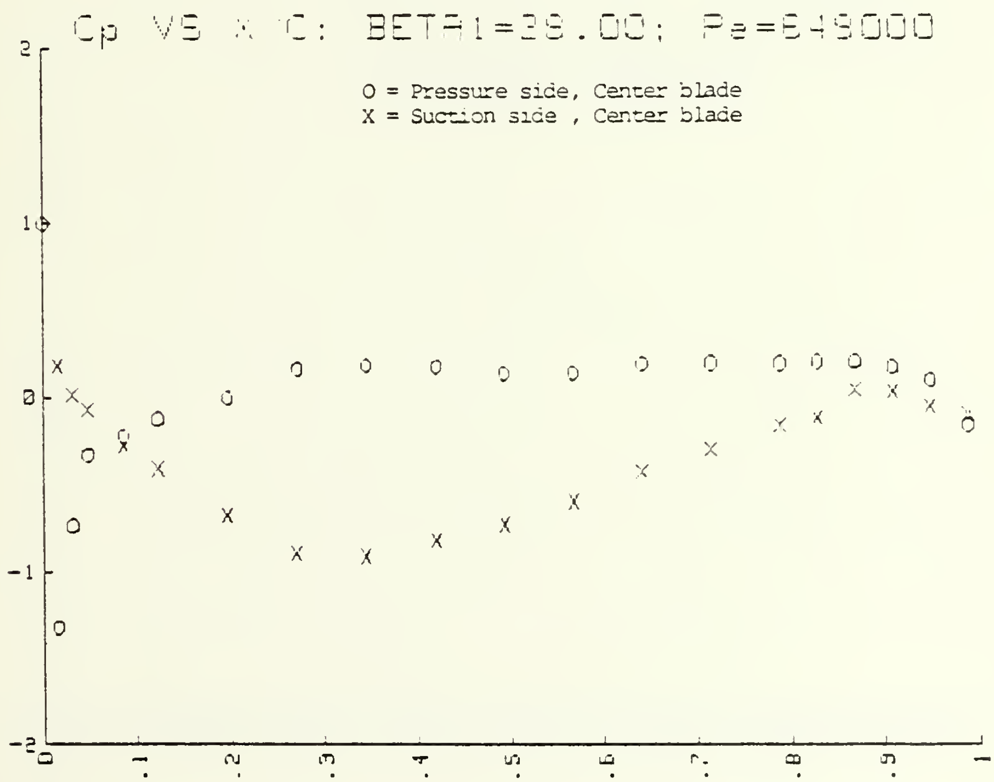

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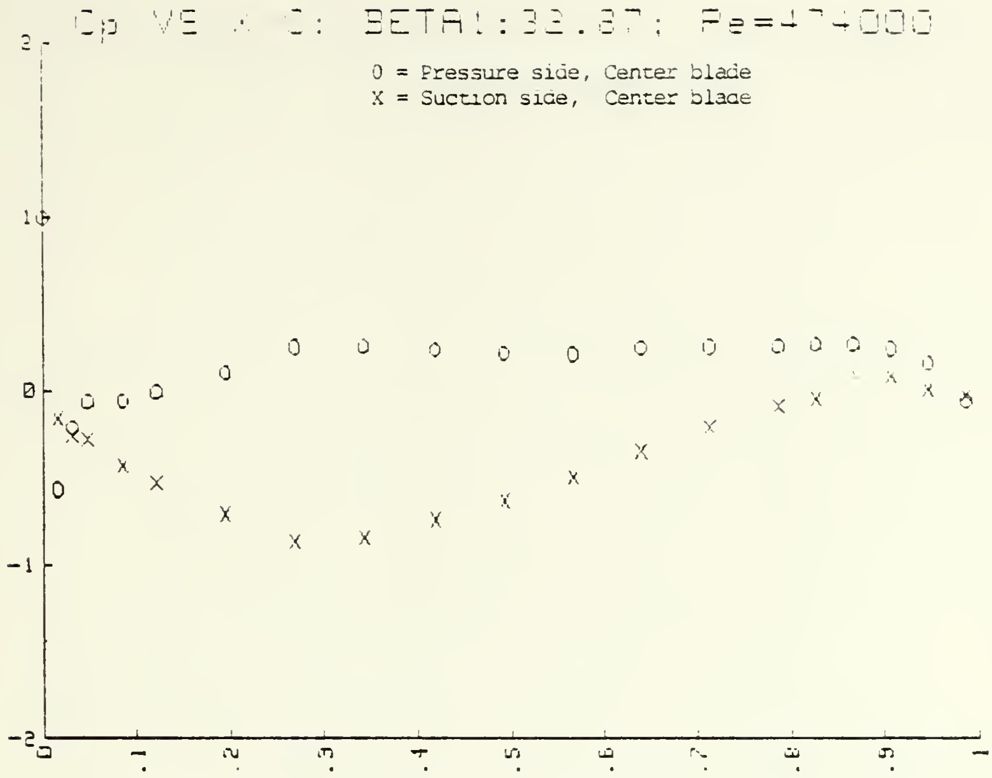

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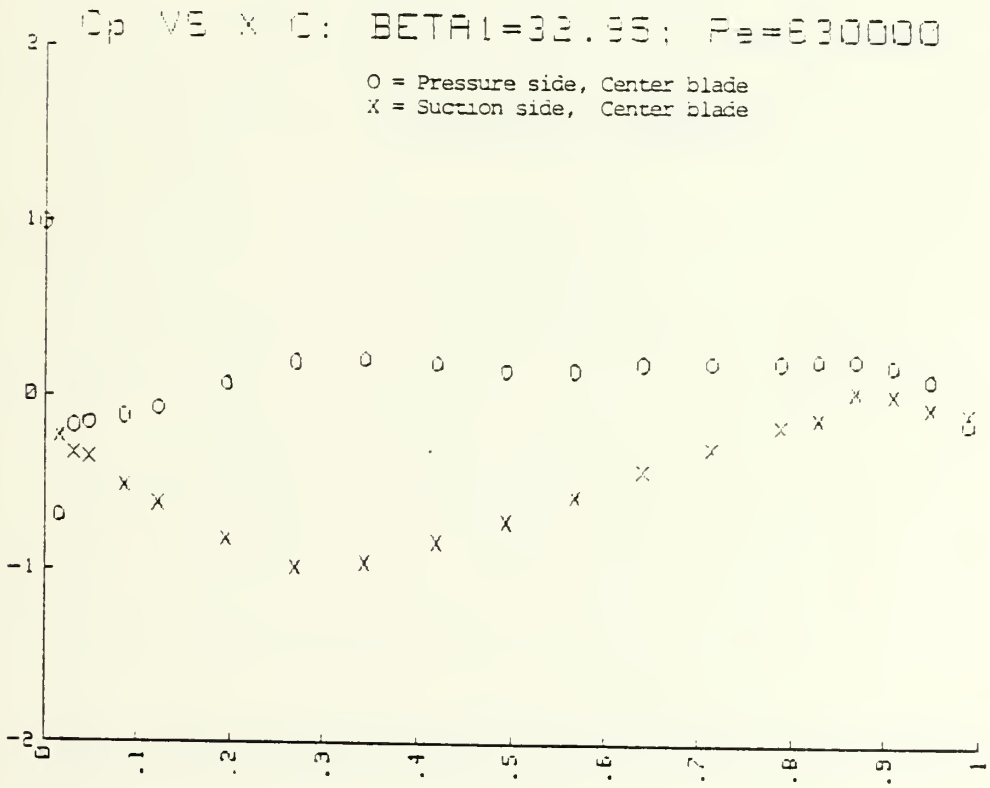

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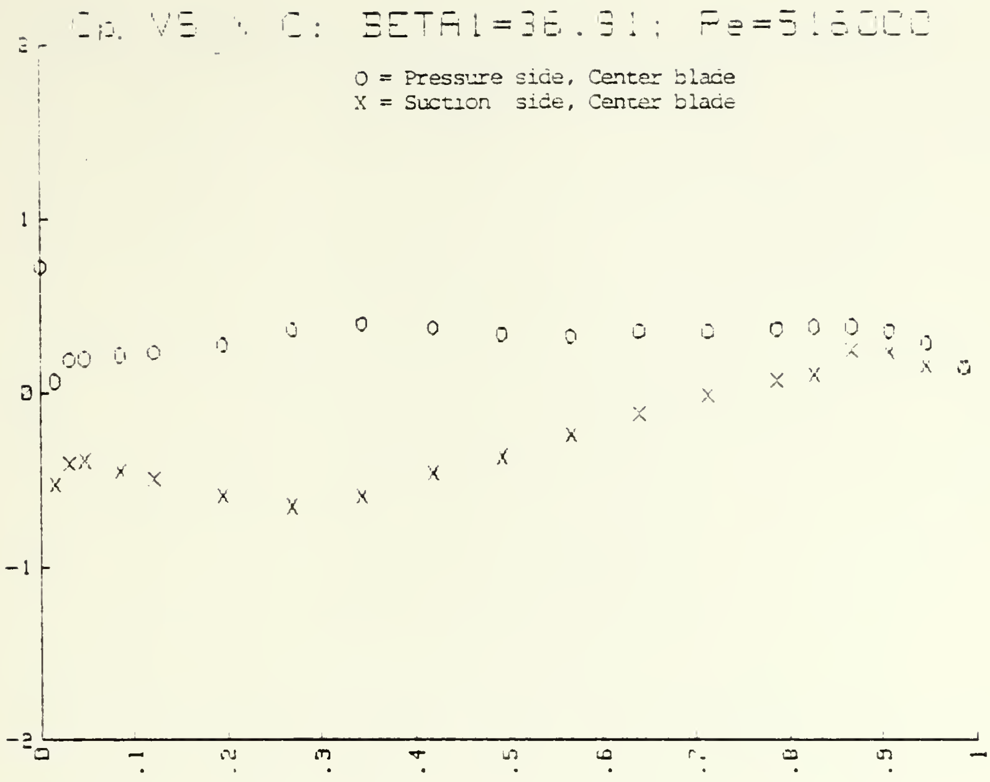

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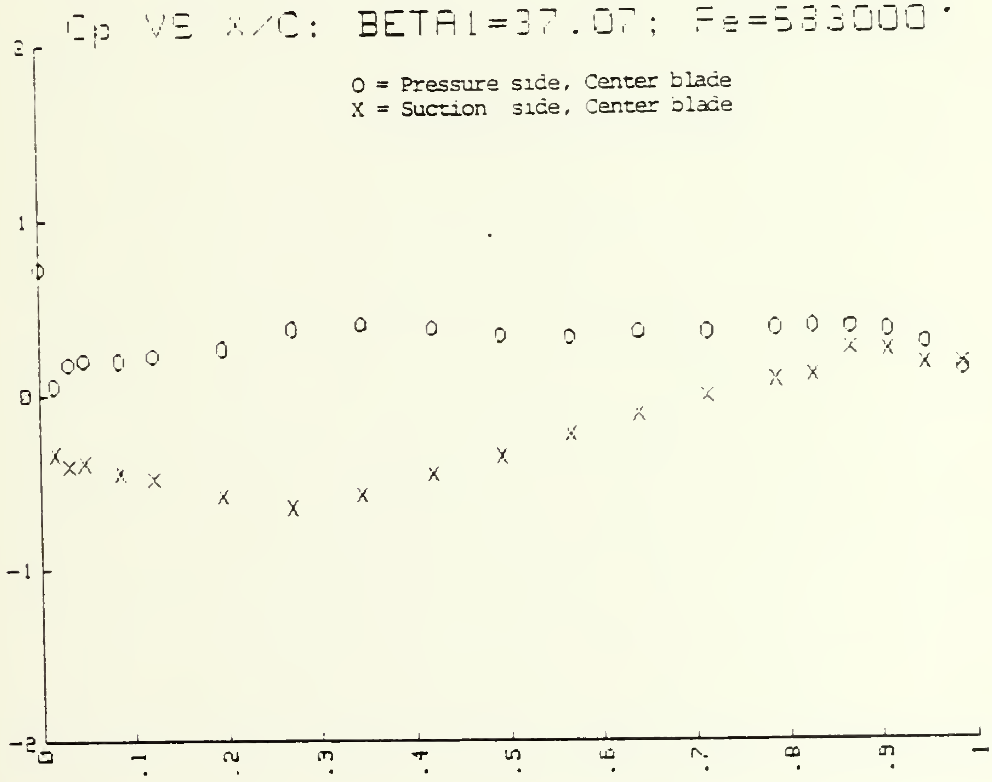

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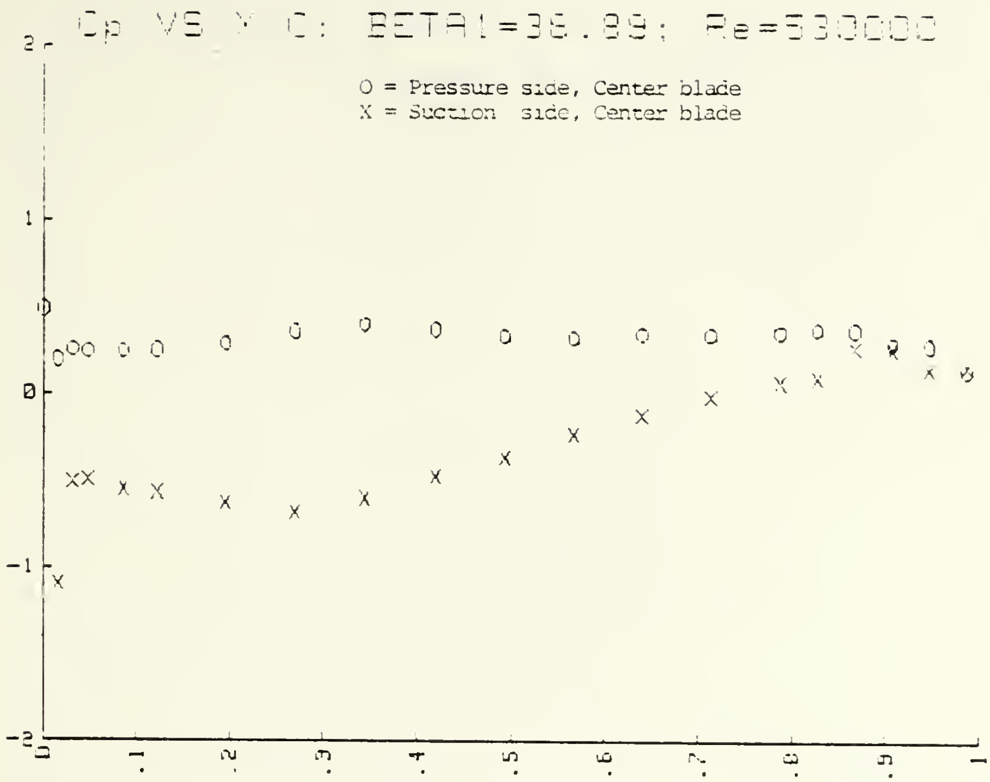

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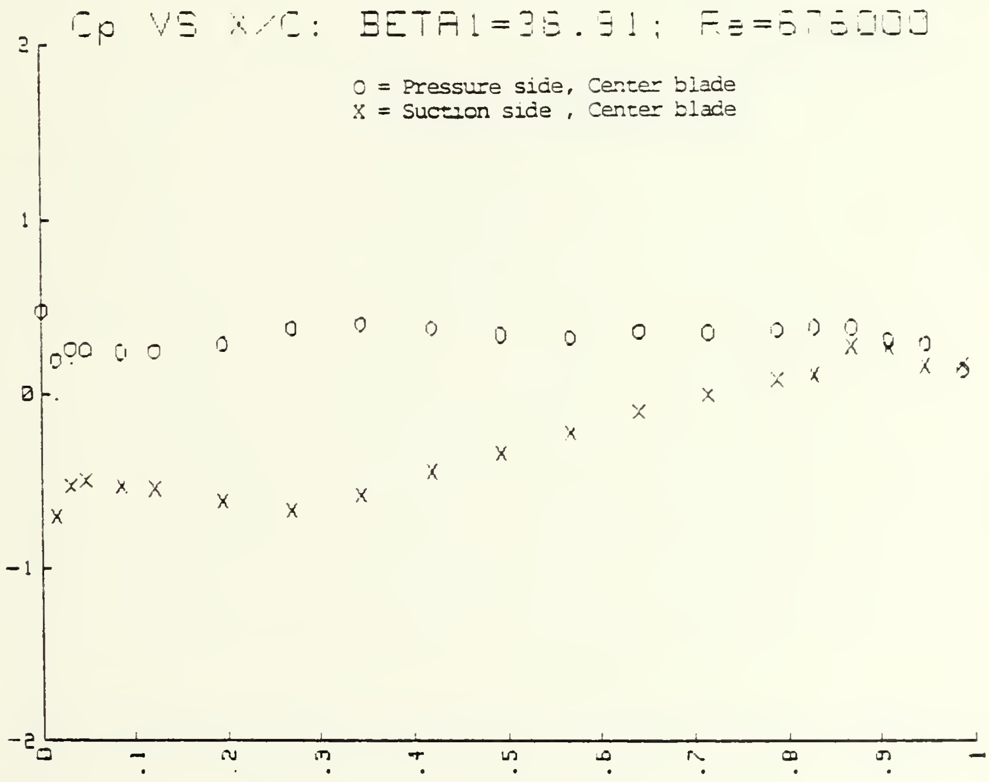

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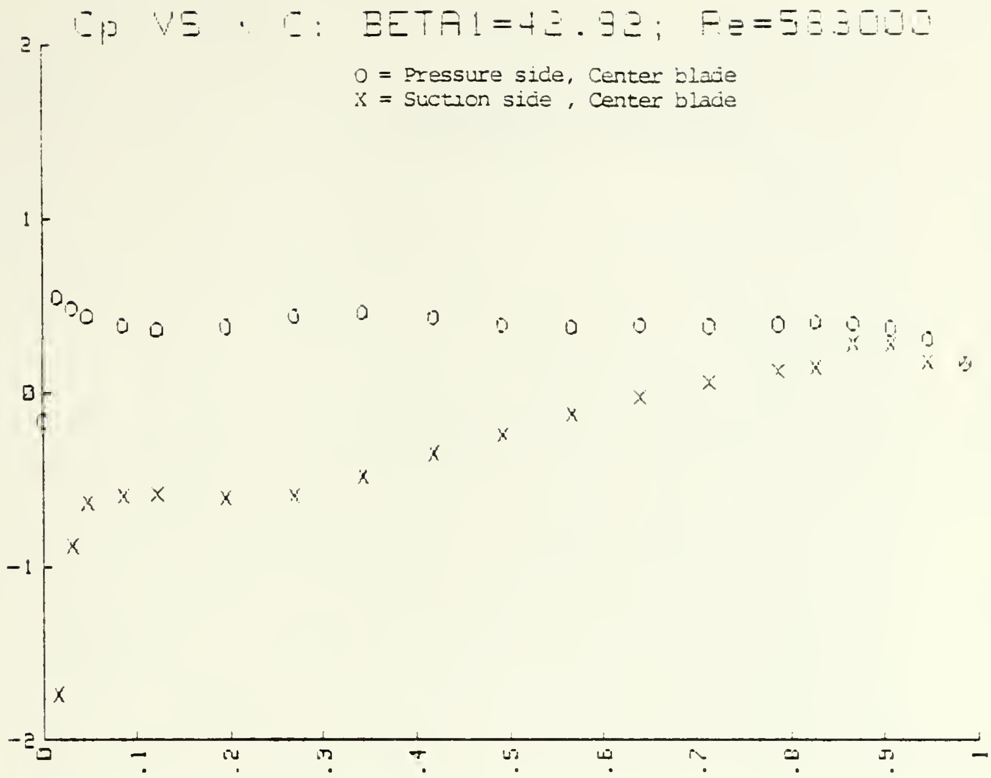

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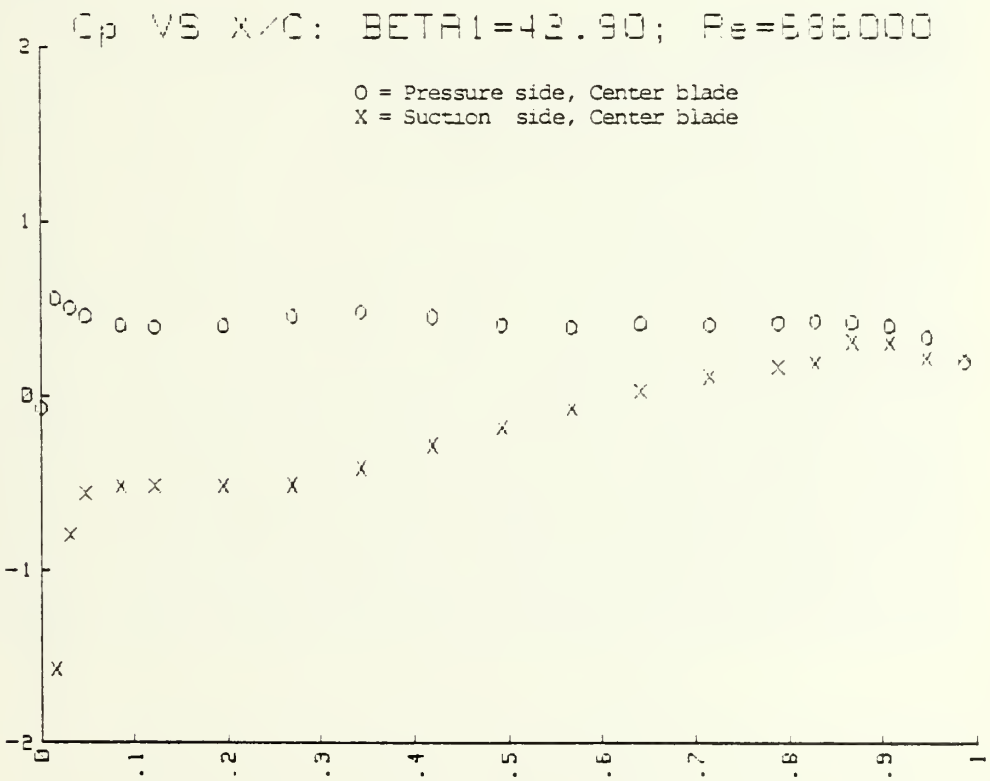

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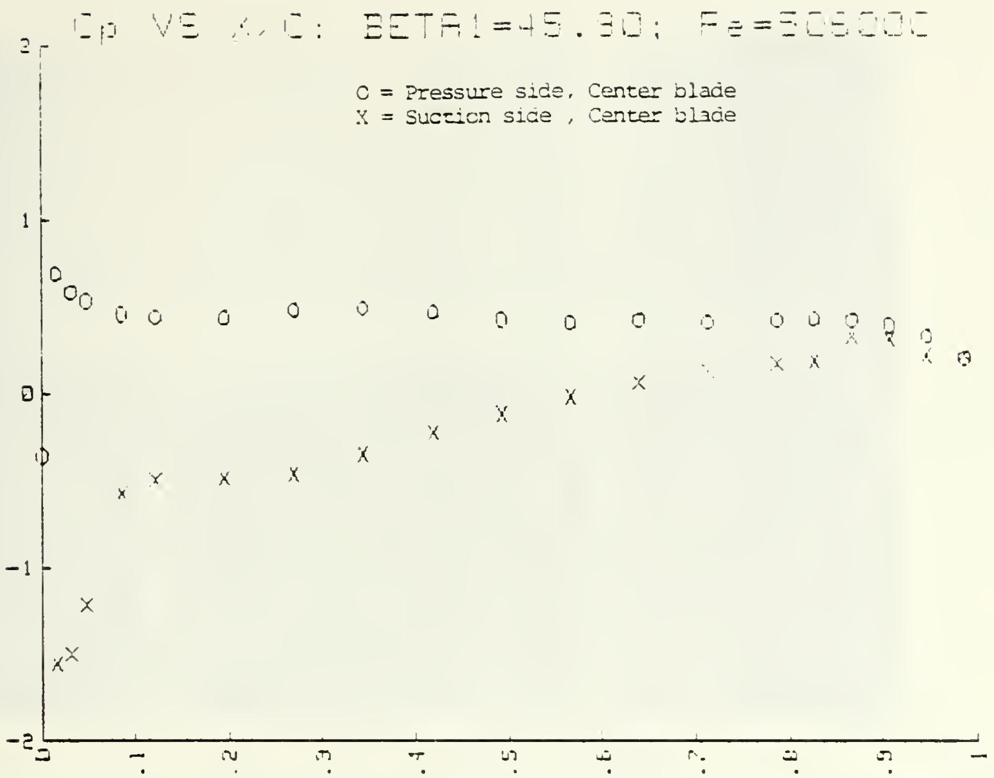

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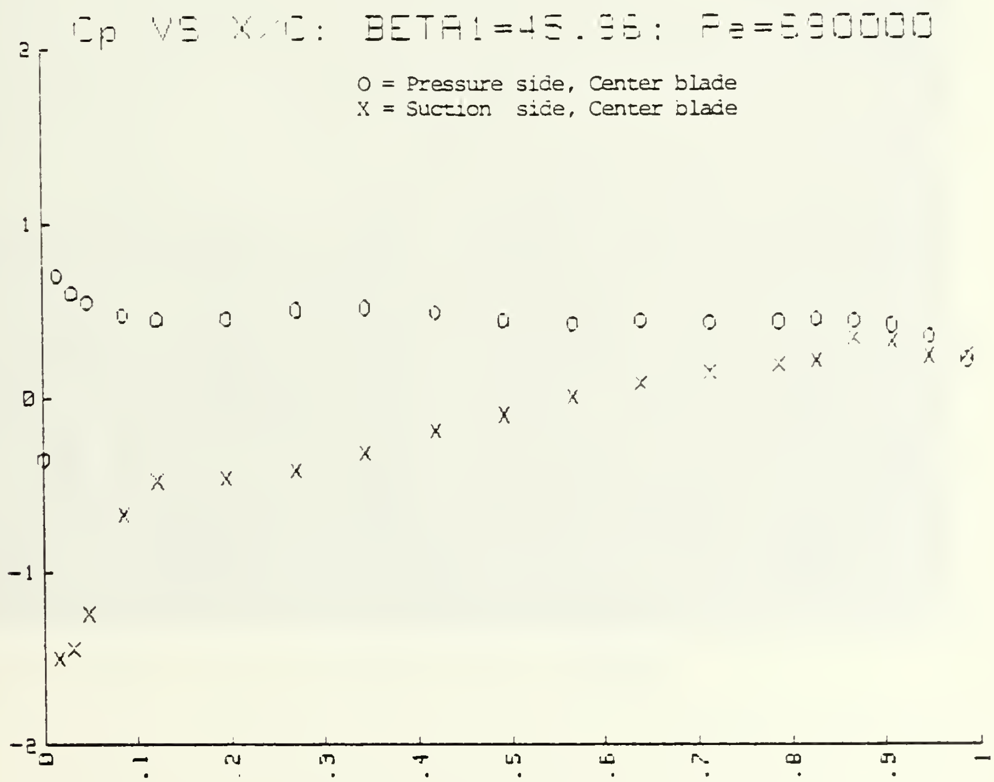

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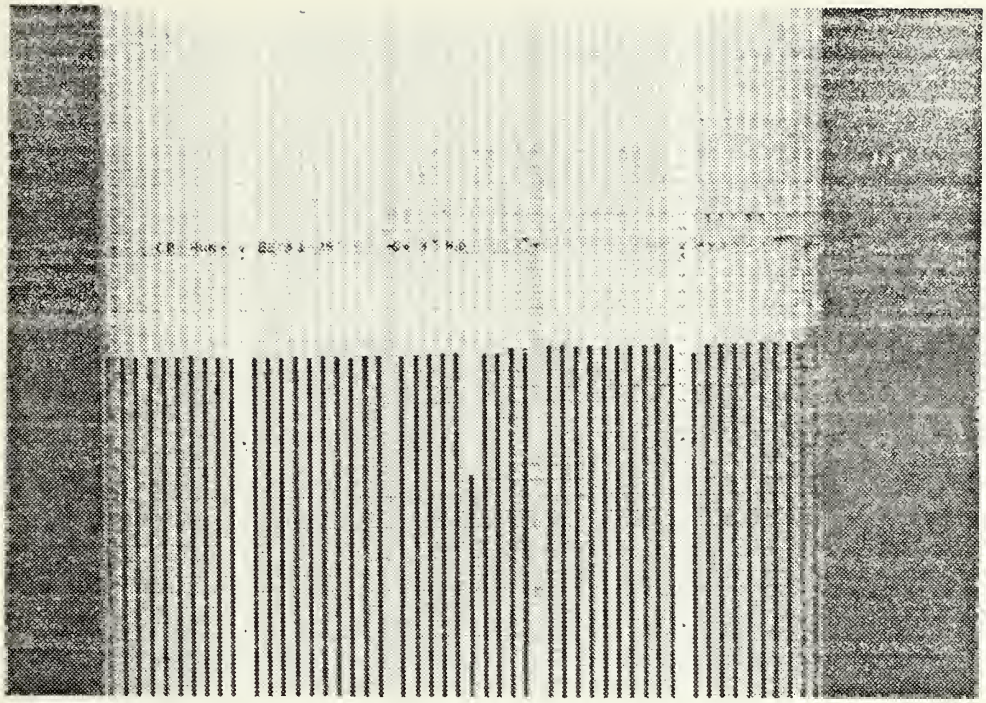

Figure A-155 β_1 = 24.49° Re = 690000

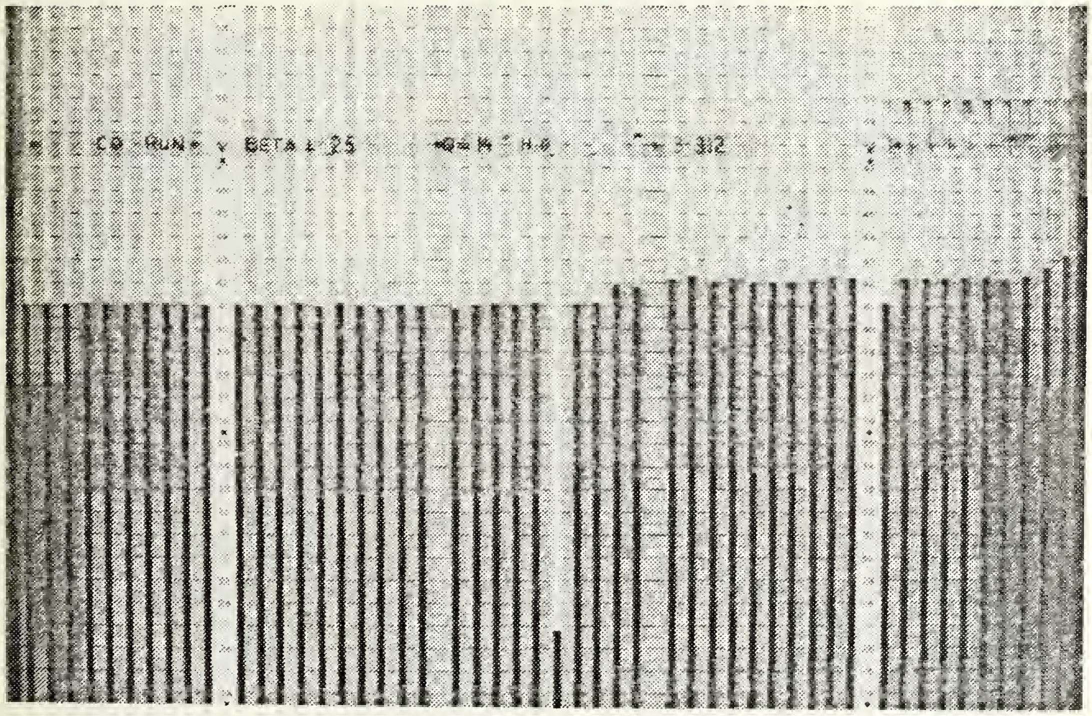

Figure A-156 β_1 = 24.80° Re = 526000

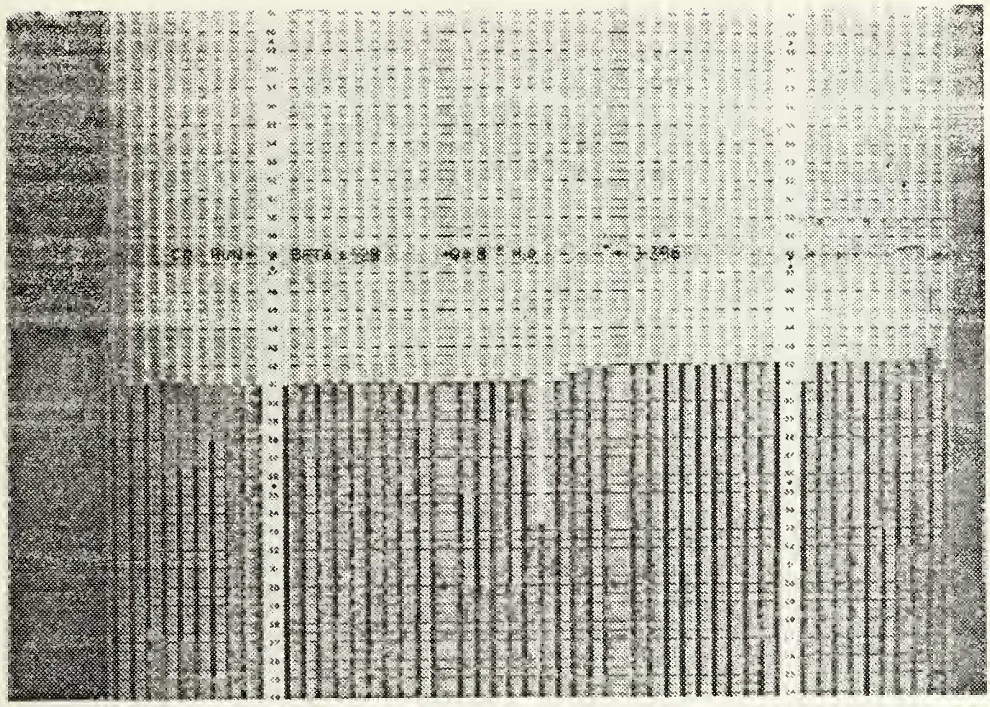

Figure A-157 β_1 = 28.00° Re = 648000

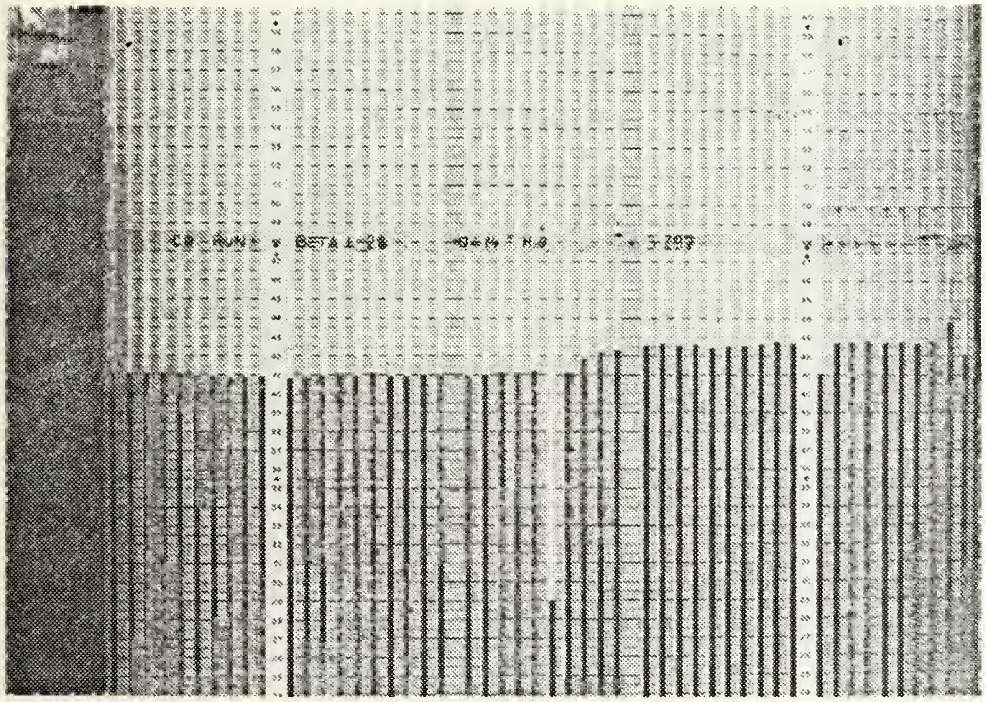

Figure A-158 β_1 = 28.12° Re = 495000

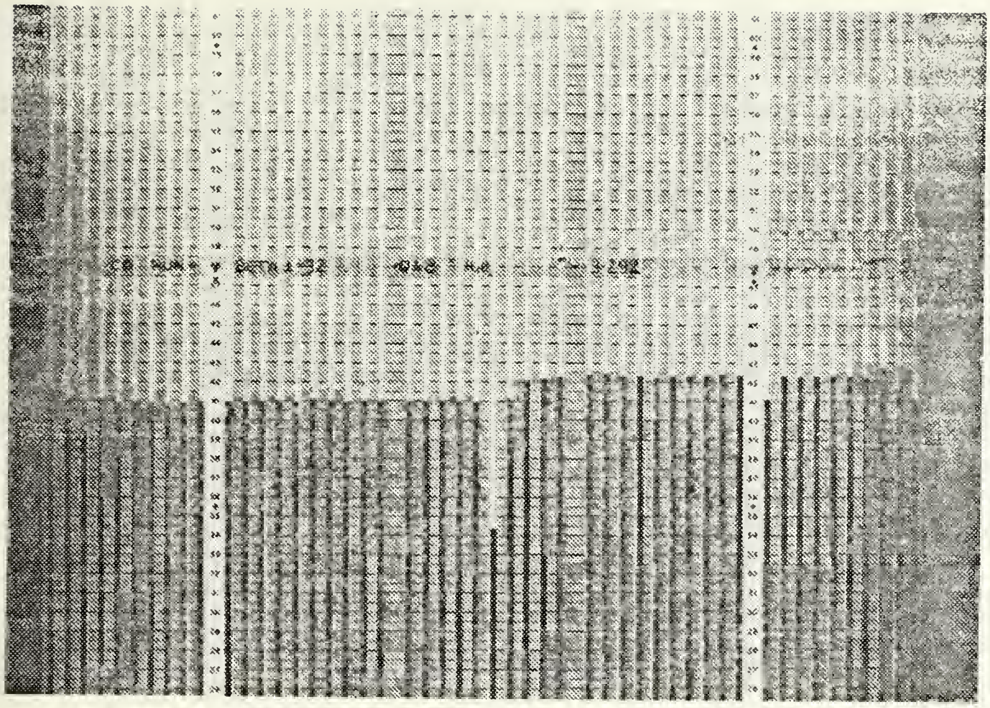

Figure A-159 β_1 = 32.95° Re = 630000

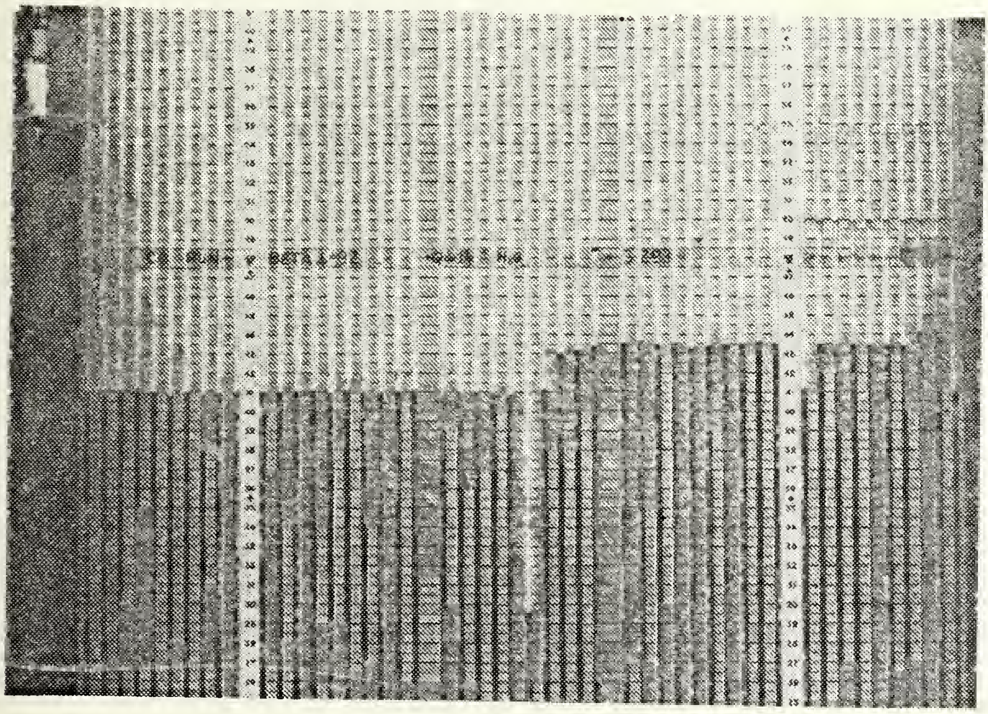

Figure A-160 β_1 = 32.87° Re = 474000

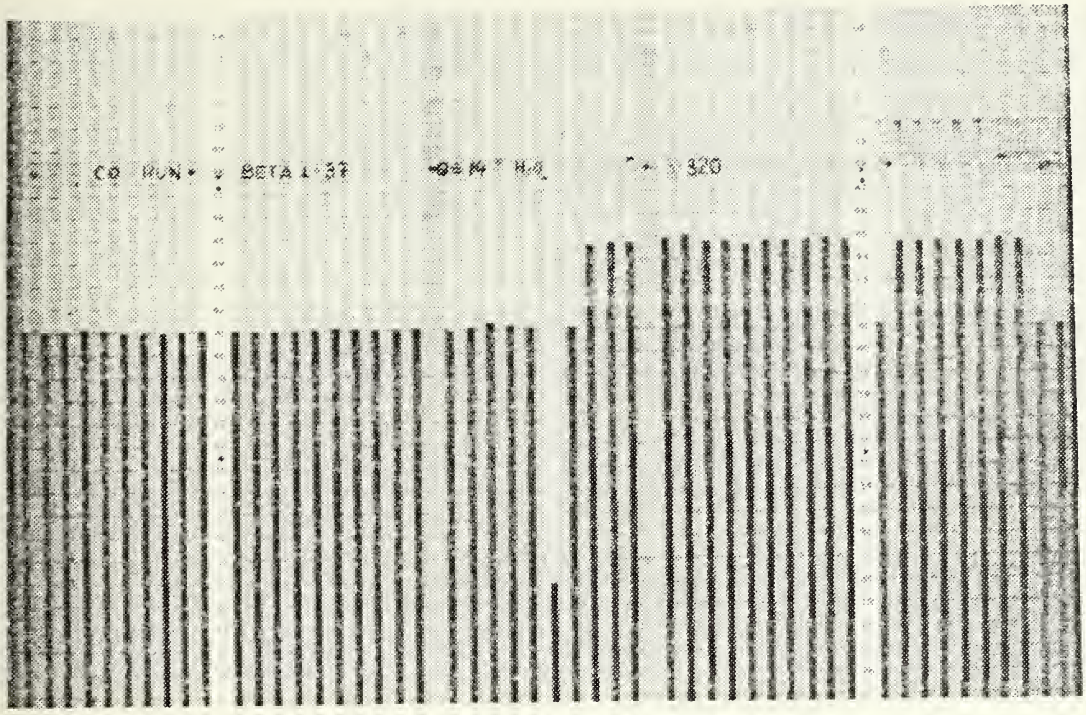

Figure A-161 $\beta_1 = 36.91°$ Re = 516000

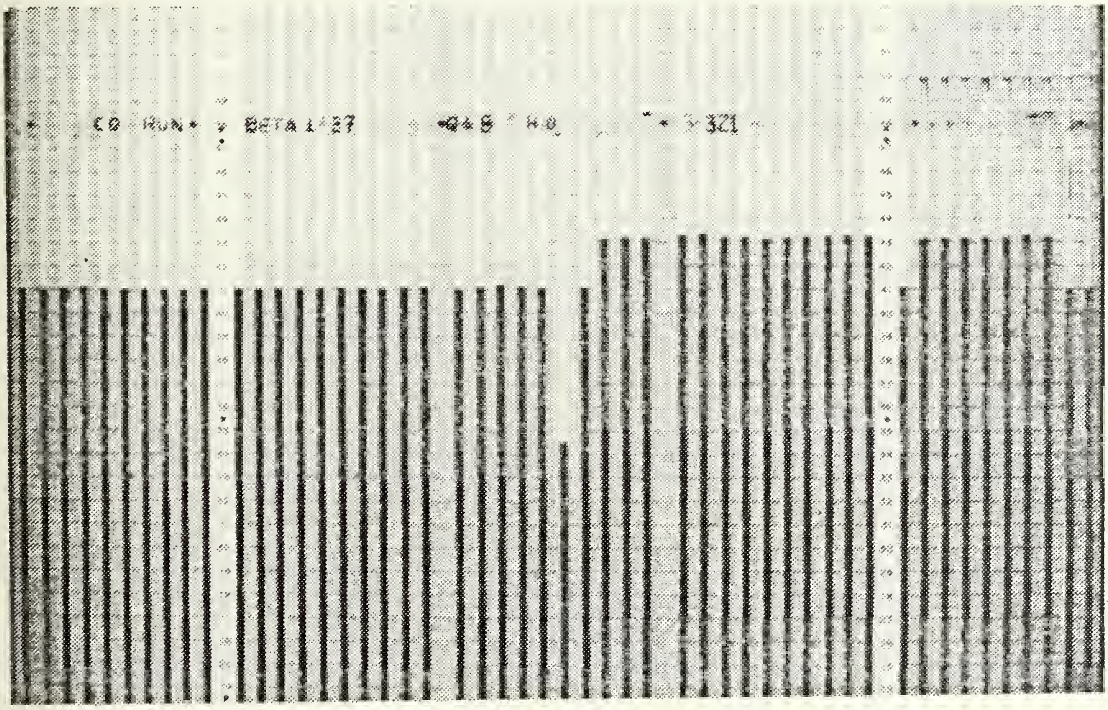

Figure A-162 $\beta_1 = 37.07°$ Re = 683000

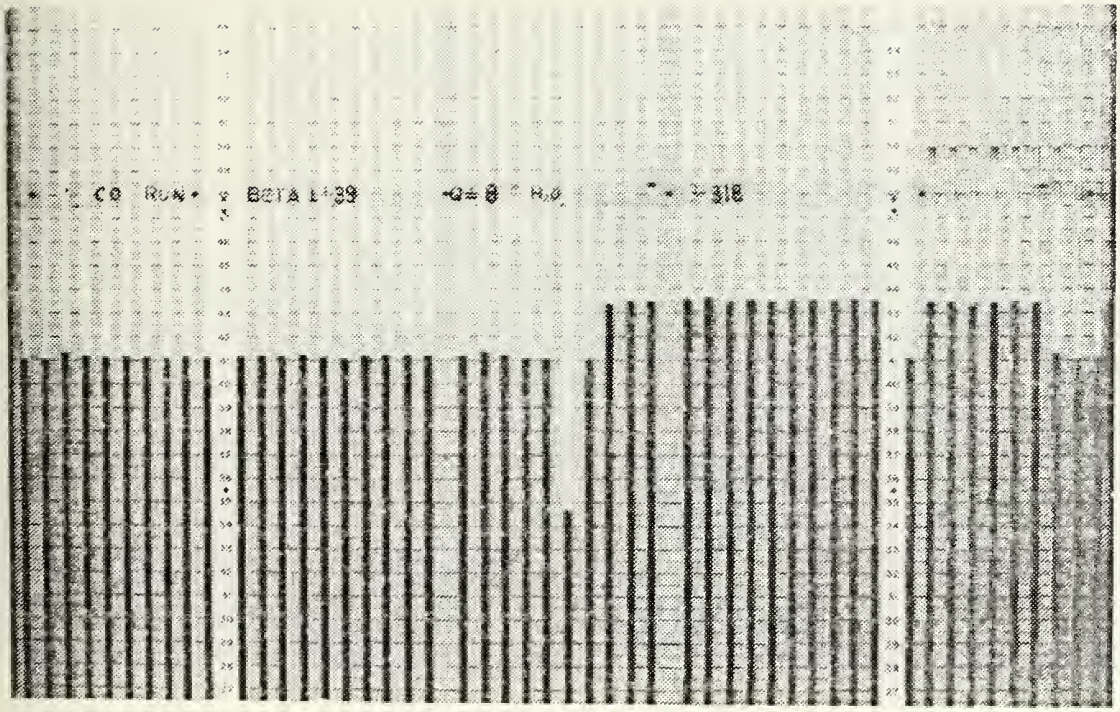

Figure A-163 β_1 = 38.91° Re = 676000

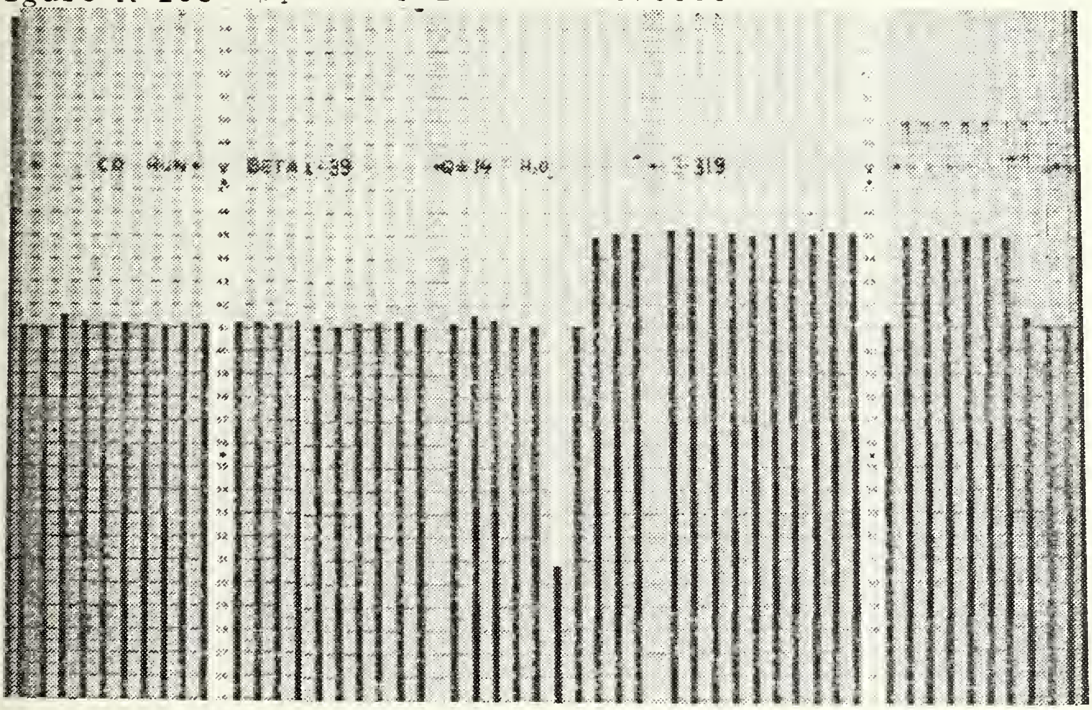

Figure A-164 β_1 = 38.89° Re = 530000

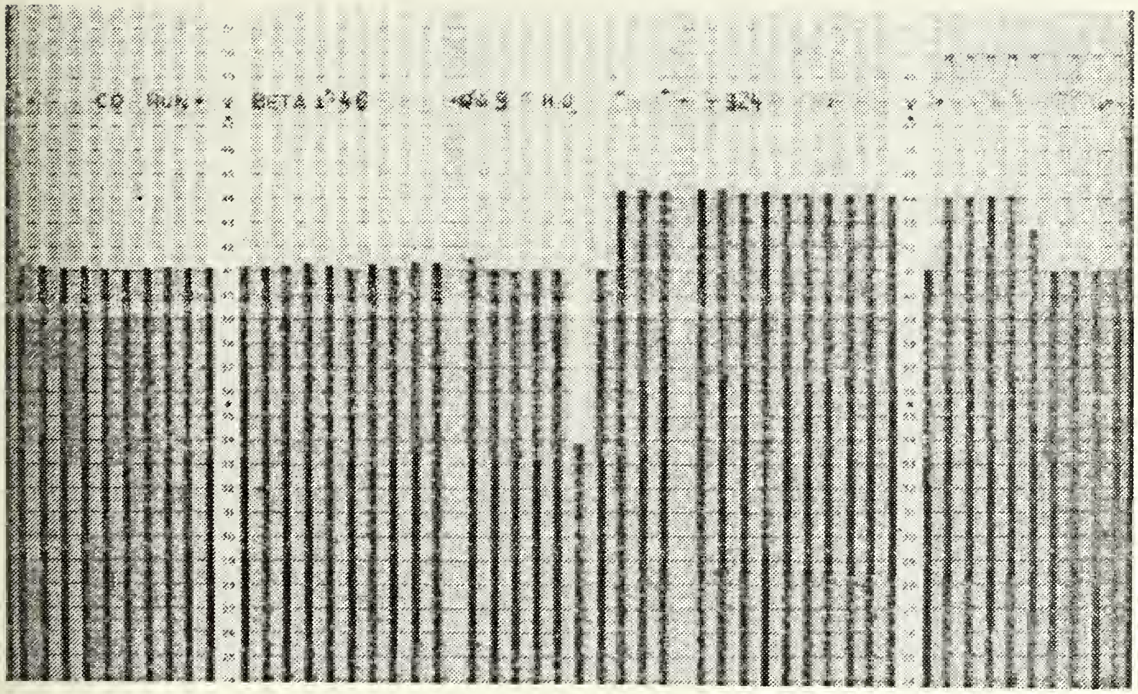

Figure A-165 β_1 = 42.90° Re = 686000

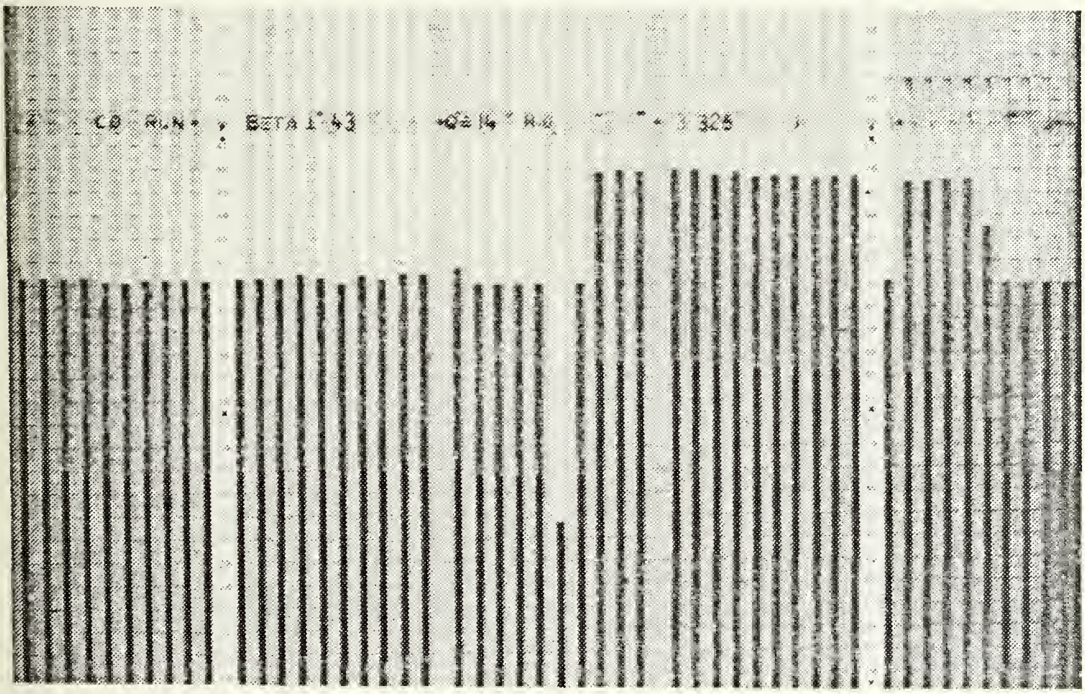

Figure A-166 β_1 = 42.92° Re = 583000

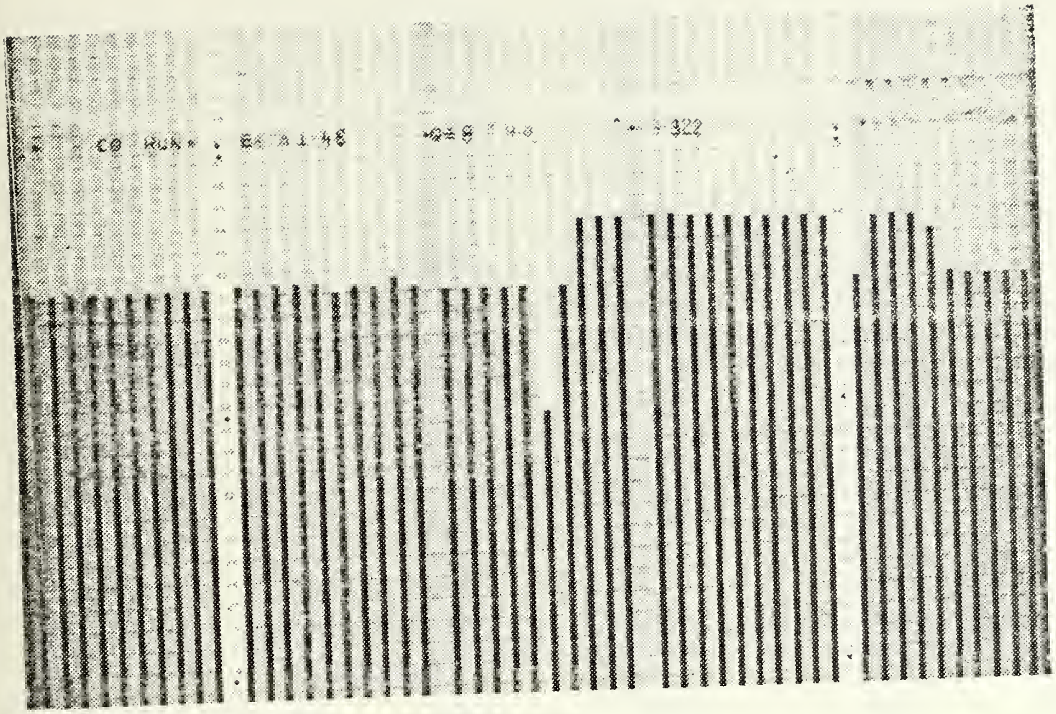

Figure A-167 β_1 = 45.96° Re = 690000

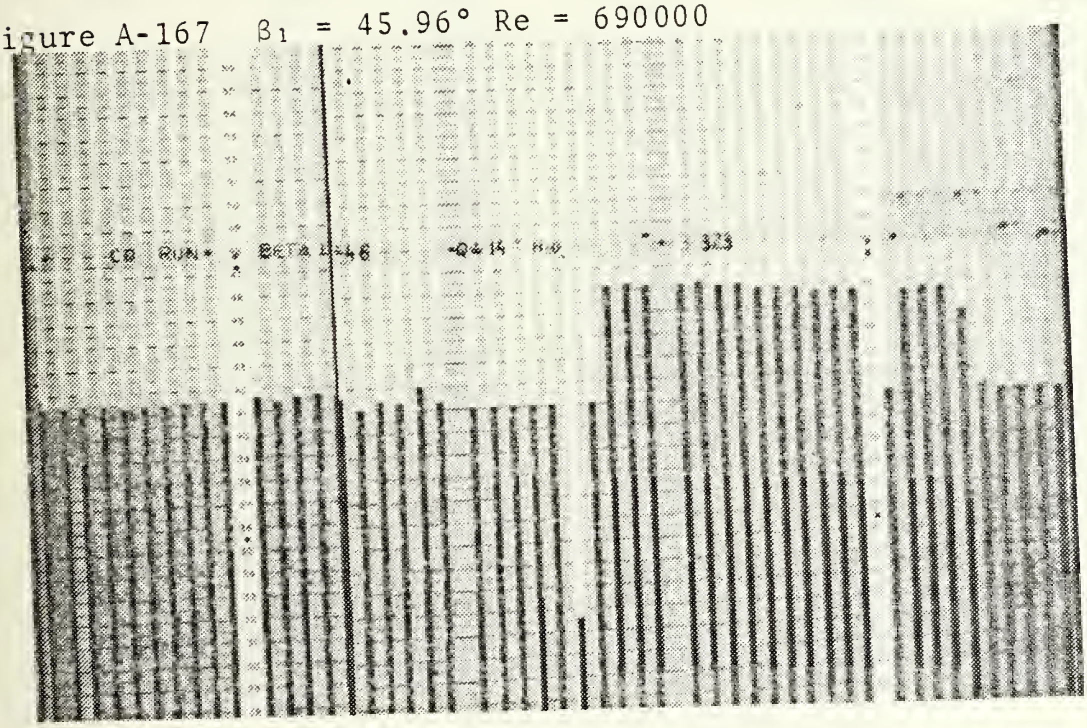

Figure A-168 β_1 = 45.90° Re = 506000

TABLE A1 BLADE-TO-BLADE PROBE DATA UPPER PLANE AT MIDSPAN

β_1 = 24.49° Re = 690000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-8.54	-.81	.9025	.0429	.1272	.9218
2	-8.33	-1.13	.8717	.0456	.1552	.9063
3	-8.08	-1.13	.7242	.0573	.2919	.8273
4	-7.80	-1.46	.6868	.0581	.3282	.8062
5	-7.57	-1.79	.7602	.0506	.2595	.8485
6	-7.32	-1.78	.8265	.0474	.1959	.8842
7	-7.03	-1.79	.8797	.0460	.1449	.9112
8	-6.82	-1.47	.9032	.0492	.1179	.9230
9	-6.31	-1.46	.9227	.0478	.0959	.9343
10	-5.78	-1.47	.9156	.0459	.1085	.9293
11	-5.54	-1.48	.9137	.0472	.1108	.9277
12	-5.27	-1.46	.8542	.0539	.1648	.8971
13	-5.04	-1.17	.7182	.0643	.2939	.8227
14	-4.79	-1.17	.6707	.0643	.3417	.7954
15	-4.54	-1.68	.7566	.0594	.2593	.8445
16	-4.30	-2.31	.8424	.0515	.1802	.8906
17	-4.04	-1.40	.9004	.0504	.1225	.9204
18	-3.53	-1.40	.9082	.0524	.1097	.9254
19	-3.30	-1.40	.9121	.0561	.1064	.9255
20	-3.05	-1.40	.9126	.0568	.1047	.9260
21	-2.76	-1.41	.9106	.0519	.1141	.9240
22	-2.54	-1.40	.9102	.0486	.1151	.9250
23	-2.40	-.94	.8986	.0476	.1262	.9199
24	-2.33	-.94	.8856	.0545	.1363	.9116
25	-2.23	-.95	.8534	.0563	.1657	.8957
26	-2.13	-.95	.7872	.0666	.2241	.8600
27	-2.03	-.94	.7296	.0688	.2805	.8281
28	-1.93	-.94	.6798	.0702	.3283	.8001
29	-1.82	-1.30	.6756	.0696	.3321	.7980
30	-1.72	-1.61	.7118	.0684	.2991	.8180
31	-1.62	-1.61	.7464	.0661	.2647	.8381
32	-1.52	-1.94	.8007	.0648	.2122	.8672
33	-1.27	-1.93	.8786	.0529	.1440	.9085
34	-1.02	-1.56	.9056	.0538	.1165	.9218
35	-.77	-1.56	.8961	.0571	.1251	.9161
36	-.52	-1.56	.8884	.0549	.1318	.9136
37	-.24	-1.56	.8889	.0532	.1338	.9135
38	-.01	-1.57	.8905	.0555	.1310	.9138
39	.24	-1.56	.8959	.0541	.1269	.9166
40	.51	-1.56	.8889	.0565	.1339	.9121
41	.75	-1.57	.8734	.0588	.1461	.9046
42	1.01	-1.19	.7557	.0719	.2575	.8401
43	1.27	-1.18	.6877	.0728	.3244	.8022
44	1.55	-1.79	.8464	.0642	.1730	.8887
45	1.78	-1.79	.9027	.0613	.1191	.9173
46	2.04	-1.78	.9077	.0590	.1127	.9213

TABLE A2 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN
β_1 = 24.49° Re = 690000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-7.02	-24.23	.9924	-.0344	.1124	.9675
2	-6.80	-24.23	.9887	-.0350	.1161	.9660
3	-6.54	-24.48	1.0018	-.0364	.1020	.9733
4	-6.28	-24.48	1.0244	-.0360	.0775	.9845
5	-6.03	-24.24	1.0223	-.0380	.0802	.9842
6	-5.78	-24.23	1.0061	-.0364	.0959	.9761
7	-5.53	-24.49	.9856	-.0366	.1191	.9653
8	-5.28	-24.48	.9975	-.0351	.1057	.9709
9	-4.78	-24.08	.9900	-.0344	.1091	.9689
10	-4.28	-24.49	1.0117	-.0351	.0912	.9778
11	-4.04	-24.11	1.0164	-.0330	.0857	.9793
12	-3.78	-24.10	.9935	-.0311	.1073	.9683
13	-3.52	-24.48	.9879	-.0326	.1152	.9653
14	-3.28	-24.48	.9982	-.0312	.1030	.9704
15	-3.02	-24.49	.9990	-.0300	.1010	.9707
16	-2.78	-24.23	.9933	-.0304	.1078	.9677
17	-2.52	-24.48	.9783	-.0308	.1239	.9603
18	-2.01	-24.48	.9988	-.0316	.1010	.9714
19	-1.76	-24.48	.9908	-.0287	.1107	.9657
20	-1.51	-24.49	.9934	-.0293	.1081	.9671
21	-1.25	-24.74	.9996	-.0266	.1014	.9690
22	-1.00	-24.49	.9942	-.0259	.1036	.9676
23	-.90	-24.48	.9837	-.0274	.1141	.9633
24	-.79	-24.23	.9834	-.0263	.1170	.9616
25	-.71	-24.49	.9692	-.0277	.1312	.9554
26	-.61	-24.48	.9736	-.0265	.1266	.9570
27	-.51	-24.48	.9752	-.0268	.1252	.9578
28	-.41	-24.73	.9744	-.0302	.1281	.9581
29	-.31	-24.49	.9786	-.0306	.1231	.9606
30	-.21	-24.59	.9771	-.0272	.1238	.9587
31	-.10	-24.58	.9839	-.0279	.1161	.9627
32	-.01	-24.59	.9849	-.0271	.1158	.9624
33	.24	-24.58	.9624	-.0295	.1406	.9518
34	.49	-24.73	.9696	-.0272	.1320	.9548
35	.74	-24.73	.9804	-.0264	.1224	.9591
36	1.00	-24.73	.9701	-.0287	.1316	.9557
37	1.26	-24.58	.9683	-.0302	.1359	.9545
38	1.50	-24.92	.9746	-.0286	.1291	.9570
39	1.75	-24.92	.9859	-.0291	.1179	.9625
40	2.01	-24.73	.9804	-.0279	.1246	.9588
41	2.25	-24.99	.9889	-.0291	.1158	.9635
42	2.51	-24.99	.9982	-.0244	.1060	.9660
43	2.76	-24.98	1.0077	-.0284	.0988	.9712
44	3.00	-24.74	.9921	-.0285	.1166	.9630
45	3.28	-24.84	.9899	-.0280	.1191	.9617
46	3.51	-24.97	1.0103	-.0293	.0959	.9730

TABLE A3 SPANWISE PROBE DATA UPPER PLANE
β_1 = 24.49° Re = 690000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	7.99	-2.16	.9031	.0593	.1408	.9094
2	7.49	-2.16	.9259	.0558	.1195	.9213
3	6.99	-1.57	.9299	.0597	.1190	.9202
4	6.50	-1.57	.9348	.0550	.1151	.9242
5	5.99	-1.55	.9437	.0518	.1089	.9287
6	5.50	-1.55	.9487	.0489	.1091	.9302
7	5.00	-1.55	.9434	.0487	.1126	.9285
8	4.49	-1.69	.9365	.0484	.1193	.9254
9	4.00	-.94	.9286	.0512	.1254	.9211
10	3.49	-1.30	.9382	.0498	.1197	.9248
11	2.99	-1.30	.9445	.0483	.1138	.9282
12	2.49	-1.72	.9555	.0412	.1103	.9334
13	1.99	-2.62	.9302	.0340	.1443	.9208

TABLE A4 SPANWISE PROBE DATA LOWER PLANE
β_1 = 24.49° Re = 690000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.97	-24.23	1.0030	-.0194	.1273	.9550
2	-2.45	-23.98	1.0076	-.0230	.1285	.9563
3	-1.96	-24.23	1.0107	-.0284	.1316	.9574
4	-1.44	-24.22	1.0063	-.0268	.1353	.9550
5	-.94	-24.22	1.0138	-.0308	.1326	.9582
6	-.42	-24.23	1.0202	-.0297	.1245	.9613
7	.11	-24.47	1.0110	-.0295	.1334	.9572
8	.64	-24.48	1.0172	-.0299	.1285	.9597
9	1.15	-24.48	1.0151	-.0310	.1320	.9586
10	1.65	-24.49	1.0040	-.0311	.1473	.9518
11	2.20	-24.73	1.0120	-.0319	.1378	.9564
12	2.71	-24.74	1.0244	-.0335	.1296	.9611
13	3.20	-24.72	1.0206	-.0302	.1281	.9600

TABLE A5 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 24.49° Re = 690000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	.9614	1.0120	.0429	.0192
.0160	.0019	-1.2119	-1.4952	.3328	.1472
.0319	.0066	-1.2517	-1.5412	.3359	.1486
.0479	.0112	-1.0050	-1.2566	.3161	.1400
.0858	.0215	-.5287	-.7071	.2745	.1219
.1218	.0303	-.2607	-.3979	.2485	.1105
.1956	.0452	-.0929	-.2043	.2310	.1028
.2695	.0576	.0386	-.0526	.2163	.0963
.3433	.0663	.0933	.0106	.2100	.0935
.4192	.0716	.0905	.0073	.2103	.0936
.4930	.0736	.0642	-.0231	.2134	.0950
.5669	.0727	.0635	-.0239	.2135	.0950
.6407	.0678	.1005	.0188	.2091	.0931
.7146	.0601	.1019	.0204	.2089	.0930
.7884	.0487	.1246	.0467	.2062	.0918
.8283	.0411	.1431	.0680	.2040	.0909
.8683	.0327	.1346	.0581	.2050	.0913
.9082	.0230	.0464	-.0436	.2154	.0959
.9481	.0123	.0365	-.0550	.2166	.0964
.9880	.0006	-.2308	-.3634	.2455	.1091
SUCTION SIDE CENTER BLADE					
.0160	.0227	.2753	.2205	.1873	.0835
.0319	.0310	.0891	.0057	.2105	.0937
.0479	.0389	-.0204	-.1207	.2230	.0992
.0858	.0563	-.2422	-.3765	.2467	.1096
.1218	.0710	-.4121	-.5726	.2635	.1170
.1956	.0970	-.7050	-.9105	.2905	.1288
.2695	.1170	-.9688	-1.2147	.3131	.1387
.3433	.1309	-1.0050	-1.2566	.3161	.1400
.4192	.1399	-.9197	-1.1581	.3090	.1369
.4930	.1432	-.8344	-1.0597	.3018	.1337
.5669	.1412	-.6972	-.9014	.2898	.1285
.6407	.1339	-.5152	-.6915	.2733	.1213
.7146	.1209	-.3808	-.5365	.2605	.1157
.7884	.1021	-.2308	-.3634	.2455	.1091
.8283	.0895	-.1882	-.3142	.2411	.1072
.8683	.0755	-.0069	-.1051	.2215	.0986
.9082	.0593	-.0154	-.1149	.2225	.0990
.9481	.0407	-.1199	-.2355	.2339	.1040
.9880	.0206	-.1669	-.2896	.2389	.1062

TABLE A6 BLADE-TO-BLADE PROBE DATA UPPER PLANE AT MIDSPAN
β_1 = 24.80° Re = 526000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-8.41	-1.74	.9148	.0536	.1309	.9313
2	-8.20	-.95	.8875	.0554	.1570	.9173
3	-7.95	-.94	.7174	.0734	.3095	.8255
4	-7.71	-.95	.6894	.0620	.3472	.8102
5	-7.46	-1.27	.7781	.0576	.2592	.8616
6	-7.19	-1.62	.8682	.0541	.1762	.9080
7	-6.96	-1.61	.9031	.0562	.1430	.9242
8	-6.46	-1.61	.9276	.0571	.1140	.9380
9	-5.95	-1.62	.9358	.0571	.1059	.9420
10	-5.72	-2.03	.9274	.0590	.1140	.9372
11	-5.47	-1.48	.9252	.0564	.1172	.9368
12	-5.22	-1.47	.8862	.0622	.1543	.9155
13	-4.98	-1.04	.7356	.0666	.3017	.8346
14	-4.73	-1.43	.6868	.0690	.3511	.8056
15	-4.49	-1.44	.7868	.0652	.2518	.8628
16	-4.24	-1.76	.8678	.0613	.1757	.9052
17	-4.00	-1.77	.9172	.0622	.1255	.9301
18	-3.50	-1.21	.9295	.0620	.1133	.9364
19	-3.26	-1.61	.9231	.0636	.1177	.9333
20	-3.02	-1.61	.9198	.0642	.1219	.9311
21	-2.76	-1.61	.9206	.0616	.1238	.9314
22	-2.52	-1.62	.9077	.0595	.1383	.9252
23	-2.27	-1.62	.8835	.0666	.1585	.9117
24	-2.16	-1.20	.8318	.0670	.2103	.8847
25	-2.06	-1.21	.7611	.0719	.2808	.8450
26	-1.97	-1.20	.7063	.0735	.3326	.8148
27	-1.86	-1.21	.6833	.0734	.3542	.8021
28	-1.76	-1.53	.7071	.0696	.3299	.8174
29	-1.67	-2.07	.7565	.0693	.2818	.8448
30	-1.56	-2.08	.8154	.0674	.2280	.8755
31	-1.47	-2.06	.8558	.0665	.1891	.8963
32	-1.37	-2.07	.8842	.0653	.1602	.9116
33	-1.27	-2.08	.9127	.0628	.1302	.9276
34	-1.02	-1.26	.9101	.0649	.1349	.9246
35	-.78	-1.71	.9139	.0648	.1329	.9258
36	-.54	-1.71	.9061	.0655	.1403	.9218
37	-.29	-1.71	.8991	.0647	.1462	.9190
38	-.05	-1.71	.8957	.0647	.1501	.9171
39	.21	-1.70	.8935	.0670	.1535	.9145
40	.46	-1.70	.8917	.0664	.1511	.9156
41	.71	-1.71	.8864	.0646	.1560	.9138
42	.96	-1.27	.7571	.0758	.2808	.8428
43	1.22	-1.28	.6956	.0758	.3405	.8089
44	1.47	-1.66	.8484	.0687	.1955	.8920
45	1.72	-1.66	.9070	.0689	.1376	.9215
46	1.98	-1.66	.9146	.0664	.1304	.9261

TABLE A7 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN

β_1 = 24.80° Re = 526000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-7.02	-24.77	1.0020	-.0225	.1187	.9752
2	-6.77	-24.78	.9969	-.0210	.1226	.9726
3	-6.52	-24.77	1.0125	-.0303	.1145	.9809
4	-6.27	-24.78	1.0284	-.0230	.0889	.9894
5	-6.01	-24.63	1.0318	-.0225	.0823	.9922
6	-5.77	-24.52	1.0000	-.0215	.1182	.9749
7	-5.51	-24.77	.9955	-.0202	.1258	.9708
8	-5.01	-24.77	1.0093	-.0224	.1106	.9790
9	-4.51	-24.53	.9969	-.0218	.1228	.9729
10	-4.27	-24.77	1.0182	-.0191	.1008	.9825
11	-4.03	-24.28	1.0280	-.0189	.0882	.9879
12	-3.77	-24.26	1.0043	-.0180	.1147	.9750
13	-3.52	-24.52	.9993	-.0176	.1189	.9728
14	-3.26	-24.77	1.0052	-.0142	.1120	.9746
15	-3.02	-24.77	1.0060	-.0123	.1074	.9758
16	-2.78	-24.51	.9881	-.0176	.1327	.9663
17	-2.52	-24.77	.9830	-.0129	.1339	.9635
18	-2.02	-24.77	1.0114	-.0154	.1076	.9773
19	-1.77	-24.76	.9934	-.0138	.1238	.9688
20	-1.51	-25.02	.9962	-.0143	.1228	.9695
21	-1.27	-24.76	1.0065	-.0161	.1145	.9744
22	-1.01	-24.78	1.0053	-.0159	.1147	.9741
23	-.77	-24.77	.9837	-.0161	.1395	.9625
24	-.67	-24.76	.9722	-.0140	.1491	.9569
25	-.57	-24.77	.9779	-.0156	.1489	.9580
26	-.48	-25.02	.9776	-.0146	.1462	.9587
27	-.36	-25.03	.9819	-.0157	.1413	.9615
28	-.27	-25.01	.9789	-.0217	.1462	.9619
29	-.16	-25.02	.9839	-.0157	.1366	.9636
30	-.08	-24.78	.9821	-.0167	.1432	.9611
31	.03	-24.87	.9811	-.0137	.1425	.9601
32	.13	-24.77	.9706	-.0156	.1535	.9556
33	.22	-24.78	.9640	-.0145	.1555	.9539
34	.49	-24.88	.9756	-.0141	.1474	.9578
35	.72	-24.78	.9721	-.0167	.1553	.9554
36	.98	-25.02	.9841	-.0131	.1398	.9611
37	1.23	-25.02	.9746	-.0137	.1481	.9573
38	1.48	-25.03	.9728	-.0166	.1533	.9563
39	1.73	-25.14	.9837	-.0141	.1432	.9601
40	1.98	-25.14	.9862	-.0150	.1366	.9634
41	2.23	-25.15	.9913	-.0166	.1309	.9668
42	2.47	-25.26	.9868	-.0113	.1354	.9624
43	2.73	-25.27	.9993	-.0162	.1250	.9696
44	2.97	-24.89	1.0017	-.0162	.1250	.9697
45	3.22	-25.27	1.0027	-.0115	.1211	.9694
46	3.47	-25.27	1.0237	-.0174	.1037	.9803

TABLE A8 SPANWISE PROBE DATA UPPER PLANE
β_1 = 24.80° Re = 526000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	M/Mref
1	7.98	-1.86	.9047	.0680	.1437	.9192
2	7.48	-1.86	.9090	.0656	.1432	.9208
3	6.99	-1.86	.9159	.0663	.1322	.9256
4	6.49	-1.86	.9263	.0641	.1253	.9302
5	5.99	-1.54	.9255	.0617	.1275	.9303
6	5.49	-1.54	.9296	.0628	.1184	.9339
7	5.00	-1.52	.9228	.0578	.1297	.9308
8	4.49	-1.54	.9250	.0610	.1277	.9304
9	3.99	-1.54	.9325	.0571	.1196	.9360
10	3.49	-1.53	.9272	.0590	.1282	.9313
11	2.99	-1.54	.9325	.0586	.1226	.9342
12	2.49	-1.54	.9389	.0520	.1204	.9384
13	1.99	-2.49	.8991	.0543	.1587	.9182

TABLE A9 SPANWISE PROBE DATA LOWER PLANE
β_1 = 24.80° Re = 526000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	M/Mref
1	-2.88	-24.52	1.0127	-.0070	.1093	.9729
2	-2.42	-24.37	1.0243	-.0159	.1078	.9779
3	-1.92	-24.37	1.0191	-.0187	.1125	.9769
4	-1.42	-24.37	1.0097	-.0194	.1243	.9718
5	-.94	-24.37	1.0089	-.0155	.1201	.9718
6	-.42	-24.51	1.0104	-.0167	.1159	.9742
7	.10	-24.60	1.0031	-.0204	.1265	.9709
8	.61	-24.63	1.0018	-.0171	.1280	.9688
9	1.09	-24.63	1.0077	-.0203	.1209	.9736
10	1.61	-24.76	.9902	-.0177	.1410	.9630
11	2.13	-24.78	1.0014	-.0172	.1285	.9686
12	2.65	-24.76	1.0038	-.0209	.1275	.9708
13	3.12	-24.77	1.0123	-.0175	.1157	.9747

TABLE A10 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 24.80 Re = 526000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	.9517	.9953	.0367	.0164
.0160	.0019	-1.1363	-1.3832	.2479	.1102
.0319	.0066	-1.2051	-1.4615	.2520	.1120
.0479	.0112	-.9484	-1.1691	.2365	.1052
.0858	.0215	-.3994	-.5437	.1997	.0889
.1218	.0303	-.1992	-.3157	.1846	.0823
.1956	.0452	-.0530	-.1492	.1728	.0771
.2695	.0576	.0797	.0019	.1614	.0720
.3433	.0663	.1251	.0537	.1574	.0702
.4192	.0716	.1313	.0607	.1568	.0700
.4930	.0736	.1005	.0257	.1596	.0712
.5669	.0727	.1005	.0257	.1596	.0712
.6407	.0678	.1374	.0677	.1562	.0697
.7146	.0601	.1362	.0663	.1564	.0698
.7884	.0487	.1583	.0915	.1543	.0688
.8283	.0411	.1693	.1041	.1533	.0684
.8683	.0327	.1681	.1027	.1534	.0684
.9082	.0230	.0809	.0033	.1613	.0720
.9481	.0123	.0772	-.0009	.1617	.0721
.9880	.0006	-.1697	-.2821	.1823	.0813
SUCTION SIDE CENTER BLADE					
.0160	.0227	.3044	.2580	.1401	.0626
.0319	.0310	.1411	.0719	.1559	.0696
.0479	.0389	.0256	-.0596	.1662	.0741
.0858	.0563	-.1955	-.3115	.1843	.0822
.1218	.0710	-.3613	-.5003	.1969	.0877
.1956	.0970	-.6536	-.8333	.2174	.0968
.2695	.1170	-.9042	-1.1188	.2337	.1039
.3433	.1309	-.9521	-1.1733	.2367	.1053
.4192	.1399	-.8710	-1.0810	.2316	.1030
.4930	.1432	-.7924	-.9914	.2266	.1008
.5669	.1412	-.7052	-.8921	.2209	.0983
.6407	.1339	-.4608	-.6137	.2041	.0909
.7146	.1209	-.3404	-.4766	.1954	.0870
.7884	.1021	-.1967	-.3129	.1844	.0822
.8283	.0895	-.1476	-.2569	.1805	.0805
.8683	.0755	.0330	-.0512	.1655	.0738
.9082	.0593	.0281	-.0568	.1660	.0740
.9481	.0407	-.0874	-.1883	.1757	.0783
.9880	.0206	-.1230	-.2289	.1786	.0796

TABLE A11 BLADE-TO-BLADE PROBE DATA UPPER PLANE AT MIDSPAN

β_1 = 28.00° Re = 648000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-8.28	-1.02	.8724	.1077	.1129	.8888
2	-8.04	-1.01	.8749	.1058	.1121	.8894
3	-7.83	-1.00	.8170	.1135	.1586	.8614
4	-7.59	-1.43	.6610	.1219	.3147	.7733
5	-7.33	-1.42	.7274	.1186	.2477	.8120
6	-7.07	-1.42	.8620	.1064	.1235	.8833
7	-6.84	-1.09	.8787	.1066	.1046	.8924
8	-6.59	-1.11	.8801	.1055	.1024	.8938
9	-6.10	-1.46	.8961	.1028	.0243	.9290
10	-5.58	-1.06	.8949	.1055	.0905	.9000
11	-5.36	-1.46	.8904	.1025	.0986	.8975
12	-5.09	-.93	.8736	.1088	.1134	.8875
13	-4.87	-.93	.7996	.1157	.1808	.8497
14	-4.62	-.94	.6394	.1220	.3401	.7594
15	-4.38	-1.72	.7264	.1197	.2541	.8091
16	-4.14	-1.72	.8668	.1077	.1257	.8824
17	-3.90	-.97	.8911	.1076	.1032	.8937
18	-3.65	-.97	.9009	.1069	.0944	.8984
19	-3.17	-.97	.8950	.1139	.0931	.8955
20	-2.92	-.98	.8937	.1149	.0955	.8941
21	-2.66	-1.42	.8949	.1105	.0980	.8950
22	-2.43	-1.11	.8918	.1107	.1013	.8933
23	-1.94	-1.12	.8121	.1218	.1718	.8525
24	-1.83	-1.11	.7311	.1252	.2515	.8089
25	-1.73	-1.11	.6737	.1329	.3046	.7757
26	-1.63	-1.33	.6812	.1307	.2979	.7805
27	-1.54	-1.85	.7535	.1276	.2311	.8193
28	-1.44	-2.19	.8230	.1256	.1631	.8558
29	-1.34	-1.78	.8650	.1187	.1300	.8762
30	-1.24	-1.80	.8919	.1121	.1043	.8916
31	-1.15	-1.38	.8947	.1112	.0994	.8941
32	-1.05	-1.37	.8952	.1167	.0981	.8924
33	-.95	-1.72	.9033	.1100	.1002	.8951
34	-.70	-1.33	.8857	.1176	.1091	.8869
35	-.46	-.92	.8777	.1171	.1170	.8832
36	-.18	-1.26	.8822	.1132	.1162	.8855
37	.04	-1.25	.8832	.1152	.1167	.8847
38	.28	-1.25	.8809	.1135	.1183	.8844
39	.52	-1.25	.8772	.1143	.1198	.8831
40	.77	-1.08	.8743	.1184	.1189	.8816
41	1.02	-1.06	.8252	.1261	.1631	.8559
42	1.26	-1.43	.6798	.1300	.3061	.7777
43	1.52	-1.99	.7852	.1286	.1996	.8356
44	1.78	-1.73	.8656	.1207	.1239	.8778
45	2.02	-1.39	.8755	.1223	.1131	.8824
46	2.28	-1.38	.8811	.1201	.1109	.8847

TABLE A12 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN

β_1 = 28.00° Re = 648000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	M/Mref
1	-6.96	-27.87	.9899	.0125	.0880	.9469
2	-6.70	-27.86	.9834	.0101	.0968	.9439
3	-6.46	-27.60	.9733	.0083	.1042	.9411
4	-6.20	-27.87	.9847	.0119	.0947	.9441
5	-5.95	-28.09	1.0102	.0082	.0694	.9574
6	-5.71	-27.60	1.0072	.0098	.0717	.9556
7	-5.46	-27.60	.9778	.0069	.1030	.9425
8	-5.22	-27.62	.9692	.0070	.1099	.9391
9	-4.71	-27.61	.9926	.0046	.0238	.9789
10	-4.21	-27.85	.9731	.0052	.1109	.9397
11	-3.95	-27.86	1.0019	.0072	.0799	.9531
12	-3.73	-27.60	1.0063	.0085	.0781	.9534
13	-3.48	-27.61	.9864	.0066	.0992	.9446
14	-3.23	-28.22	.9873	.0050	.1025	.9439
15	-2.98	-27.86	1.0013	.0106	.0827	.9504
16	-2.73	-27.86	.9990	.0093	.0890	.9482
17	-2.48	-27.85	.9748	.0091	.1163	.9359
18	-2.23	-27.85	.9771	.0105	.1130	.9367
19	-1.73	-27.85	.9954	.0115	.0928	.9456
20	-1.48	-27.86	.9841	.0103	.1076	.9394
21	-1.22	-28.10	.9965	.0094	.0952	.9455
22	-.98	-27.97	1.0075	.0131	.0806	.9504
23	-.49	-27.98	.9701	.0134	.1188	.9327
24	-.39	-28.09	.9702	.0113	.1215	.9325
25	-.28	-28.37	.9761	.0140	.1152	.9342
26	-.19	-28.36	.9880	.0138	.1019	.9404
27	-.09	-28.37	.9900	.0111	.1064	.9399
28	.00	-28.09	.9919	.0154	.1008	.9404
29	.10	-28.22	.9901	.0145	.1062	.9385
30	.20	-28.10	.9837	.0120	.1106	.9374
31	.30	-28.10	.9752	.0112	.1172	.9346
32	.40	-28.09	.9732	.0127	.1224	.9317
33	.49	-28.09	.9735	.0138	.1246	.9304
34	.75	-28.35	.9910	.0116	.1074	.9393
35	1.00	-28.36	.9924	.0136	.1032	.9402
36	1.27	-28.37	.9892	.0116	.1086	.9387
37	1.50	-28.37	.9713	.0120	.1298	.9289
38	1.74	-28.48	.9844	.0127	.1134	.9360
39	2.00	-28.48	1.0021	.0100	.0965	.9450
40	2.24	-28.37	.9916	.0111	.1064	.9400
41	2.49	-28.35	.9921	.0127	.1059	.9395
42	2.74	-28.63	.9888	.0132	.1077	.9383
43	2.98	-28.23	.9890	.0126	.1076	.9387
44	3.24	-28.37	.9782	.0122	.1173	.9343
45	3.48	-28.37	.9809	.0127	.1150	.9351
46	3.73	-28.37	1.0053	.0166	.0874	.9461

β_1 = 28.00° Re = 648000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	7.99	-2.26	.8622	.1223	.1293	.8747
2	7.49	-1.99	.8824	.1215	.1106	.8844
3	6.99	-1.55	.8893	.1200	.1040	.8862
4	6.50	-1.15	.8943	.1205	.0975	.8910
5	6.00	-1.17	.8979	.1191	.0963	.8924
6	5.50	-1.16	.8945	.1197	.1005	.8902
7	5.00	-1.15	.8904	.1201	.1034	.8886
8	4.49	-1.16	.8876	.1164	.1083	.8878
9	4.00	-1.00	.8871	.1177	.1056	.8883
10	3.50	-1.01	.8848	.1163	.1083	.8876
11	3.00	-1.19	.8839	.1143	.1110	.8873
12	2.49	-2.06	.8869	.1138	.1107	.8879
13	2.00	-2.04	.8667	.1090	.1330	.8791

TABLE A14 SPANWISE PROBE DATA LOWER PLANE
β_1 = 28.00° Re = 648000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.85	-27.60	.9951	.0190	.0913	.9429
2	-2.39	-27.61	1.0026	.0108	.0901	.9473
3	-1.91	-27.59	1.0146	.0063	.0791	.9543
4	-1.40	-27.61	1.0152	.0068	.0784	.9544
5	-.92	-27.62	1.0161	.0087	.0753	.9549
6	-.39	-27.61	1.0103	.0088	.0814	.9521
7	.11	-27.97	1.0065	.0057	.0907	.9494
8	.63	-27.85	.9977	.0047	.0987	.9461
9	1.11	-27.87	.9914	.0053	.1004	.9449
10	1.62	-28.05	.9811	.0019	.1164	.9392
11	2.15	-28.37	.9720	.0015	.1218	.9366
12	2.67	-28.37	.9763	.0030	.0906	.9493
13	3.15	-28.37	.9770	.0016	.1192	.9380

TABLE A15 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 28.00° Re = 648000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	.9902	1.0232	.0211	.0094
.0160	.0019	-1.3237	-1.6370	.3326	.1471
.0319	.0066	-.7417	-.9679	.2861	.1269
.0479	.0112	-.3339	-.4991	.2493	.1108
.0858	.0215	-.2285	-.3778	.2390	.1063
.1218	.0303	-.1320	-.2669	.2292	.1019
.1956	.0452	-.0108	-.1276	.2163	.0963
.2695	.0576	.1553	.0634	.1974	.0879
.3433	.0663	.1748	.0858	.1950	.0869
.4192	.0716	.1665	.0763	.1960	.0873
.4930	.0736	.1321	.0367	.2001	.0891
.5669	.0727	.1329	.0376	.2000	.0891
.6407	.0678	.1837	.0961	.1940	.0864
.7146	.0601	.1897	.1030	.1932	.0861
.7884	.0487	.1920	.1055	.1930	.0860
.8283	.0411	.2024	.1176	.1917	.0854
.8683	.0327	.2039	.1193	.1915	.0853
.9082	.0230	.1725	.0832	.1953	.0870
.9481	.0123	.1015	.0015	.2037	.0907
.9880	.0006	-.1589	-.2978	.2319	.1032
SUCTION SIDE CENTER BLADE					
.0160	.0227	.1710	.0814	.1955	.0871
.0319	.0310	.0102	-.1035	.2140	.0953
.0479	.0389	-.0751	-.2015	.2232	.0993
.0858	.0563	-.2808	-.4380	.2441	.1085
.1218	.0710	-.4177	-.5954	.2572	.1143
.1956	.0970	-.6811	-.8982	.2809	.1246
.2695	.1170	-.8995	-1.1493	.2993	.1327
.3433	.1309	-.9190	-1.1717	.3009	.1334
.4192	.1399	-.8254	-1.0642	.2932	.1300
.4930	.1432	-.7327	-.9575	.2853	.1266
.5669	.1412	-.6025	-.8079	.2740	.1216
.6407	.1339	-.4379	-.6187	.2591	.1151
.7146	.1209	-.3010	-.4613	.2461	.1094
.7884	.1021	-.1596	-.2987	.2320	.1032
.8283	.0895	-.1185	-.2514	.2278	.1013
.8683	.0755	.0409	-.0682	.2106	.0938
.9082	.0593	.0364	-.0734	.2111	.0940
.9481	.0407	-.0571	-.1809	.2213	.0985
.9880	.0206	-.1020	-.2325	.2260	.1006

TABLE A16 BLADE-TO-BLADE PROBE DATA UPPER PLANE AT MIDSPAN

β_1 = 28.12° Re = 495000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	M/Mref
1	-8.28	-1.37	.8933	.1199	.1153	.8979
2	-8.08	-1.36	.8944	.1184	.1143	.8990
3	-7.83	-1.37	.8414	.1140	.1736	.8716
4	-7.59	-1.37	.6804	.1199	.3339	.7829
5	-7.34	-1.79	.7609	.1166	.2510	.8295
6	-7.09	-1.77	.8896	.1154	.1250	.8955
7	-6.84	-1.77	.9013	.1160	.1124	.9014
8	-6.59	-1.78	.9022	.1156	.1122	.9017
9	-6.10	-1.43	.9119	.1193	.1254	.8961
10	-5.59	-1.42	.9107	.1194	.1004	.9057
11	-5.37	-1.87	.9048	.1173	.1077	.9031
12	-5.09	-1.87	.8948	.1161	.1226	.8967
13	-4.87	-1.59	.8265	.1172	.1890	.8625
14	-4.63	-1.58	.6635	.1239	.3527	.7712
15	-4.39	-1.59	.7677	.1192	.2426	.8328
16	-4.14	-1.80	.8974	.1181	.1200	.8972
17	-3.90	-1.80	.9082	.1182	.1056	.9038
18	-3.66	-1.78	.9137	.1220	.0988	.9055
19	-3.17	-1.80	.9294	.1203	.0850	.9131
20	-2.93	-1.80	.9131	.1231	.1056	.9024
21	-2.68	-1.78	.9082	.1181	.1098	.9022
22	-2.43	-1.80	.9032	.1263	.1135	.8971
23	-2.17	-1.80	.8964	.1238	.1213	.8943
24	-1.94	-1.32	.8250	.1204	.1945	.8591
25	-1.83	-1.31	.7455	.1198	.2698	.8188
26	-1.73	-1.59	.6837	.1282	.3317	.7815
27	-1.63	-1.58	.6919	.1162	.3198	.7916
28	-1.53	-1.83	.7664	.1253	.2502	.8276
29	-1.44	-2.27	.8404	.1240	.1801	.8652
30	-1.34	-2.25	.8893	.1161	.1333	.8920
31	-1.24	-2.25	.9074	.1252	.1124	.8984
32	-1.15	-2.23	.9121	.1213	.1038	.9037
33	-1.05	-1.99	.9067	.1221	.1080	.9012
34	-.94	-1.98	.9098	.1202	.1095	.9017
35	-.70	-2.02	.9000	.1268	.1242	.8924
36	-.46	-1.63	.8925	.1242	.1205	.8941
37	-.20	-1.64	.8896	.1255	.1263	.8910
38	.03	-1.64	.8923	.1235	.1239	.8930
39	.27	-1.64	.8931	.1280	.1187	.8933
40	.52	-1.64	.8915	.1222	.1244	.8932
41	.77	-1.66	.9007	.1226	.1127	.8986
42	1.02	-1.65	.8498	.1239	.1647	.8722
43	1.27	-1.65	.6910	.1253	.3213	.7877
44	1.52	-1.98	.8057	.1253	.2128	.8476
45	1.79	-1.97	.8902	.1238	.1234	.8928
46	2.02	-1.97	.8988	.1250	.1176	.8955

TABLE A17 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN
β_1 = 28.12° Re = 495000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-6.95	-27.95	.9945	.0343	.0983	.9479
2	-6.72	-27.94	.9801	.0364	.1096	.9416
3	-6.46	-27.86	.9750	.0324	.1200	.9386
4	-6.21	-28.12	.9967	.0356	.0983	.9475
5	-5.96	-28.11	1.0188	.0332	.0735	.9599
6	-5.72	-27.70	1.0095	.0313	.0876	.9544
7	-5.46	-27.70	.9801	.0300	.1187	.9405
8	-5.17	-27.85	.9833	.0291	.1166	.9419
9	-4.72	-27.88	.9947	.0296	.1312	.9365
10	-4.22	-27.86	.9839	.0285	.1171	.9420
11	-3.98	-28.11	1.0104	.0338	.0842	.9548
12	-3.72	-27.60	1.0163	.0317	.0839	.9561
13	-3.48	-27.61	.9947	.0314	.1046	.9466
14	-3.23	-28.11	.9927	.0328	.1108	.9433
15	-2.98	-28.11	1.0091	.0345	.0831	.9549
16	-2.74	-27.87	.9991	.0324	.1027	.9472
17	-2.49	-27.87	.9735	.0278	.1299	.9364
18	-2.23	-28.22	.9853	.0310	.1174	.9409
19	-1.72	-28.11	1.0198	.0122	.1014	.9572
20	-1.48	-28.11	.9900	.0324	.1184	.9402
21	-1.23	-28.35	1.0104	.0249	.0996	.9522
22	-.98	-27.97	1.0131	.0377	.0907	.9506
23	-.73	-28.11	.9853	.0403	.1148	.9381
24	-.49	-28.10	.9835	.0331	.1213	.9384
25	-.39	-28.08	.9790	.0261	.1273	.9385
26	-.30	-28.20	.9876	.0293	.1234	.9393
27	-.20	-28.34	.9840	.0209	.1197	.9441
28	-.09	-28.31	1.0004	.0352	.1035	.9457
29	-.00	-28.28	.9990	.0323	.1114	.9437
30	.09	-28.10	.9791	.0314	.1271	.9364
31	.19	-28.10	.9909	.0375	.1156	.9393
32	.30	-28.08	.9854	.0309	.1200	.9399
33	.41	-28.09	.9884	.0304	.1169	.9416
34	.50	-28.33	.9889	.0285	.1210	.9407
35	.74	-28.37	.9882	.0375	.1242	.9357
36	1.00	-28.09	1.0073	.0257	.1027	.9504
37	1.25	-28.10	.9877	.0311	.1213	.9395
38	1.50	-28.35	.9772	.0302	.1312	.9351
39	1.74	-28.34	.9779	.0335	.1273	.9354
40	2.00	-28.34	.9952	.0321	.1095	.9443
41	2.25	-28.36	.9903	.0311	.1135	.9428
42	2.50	-28.87	.9881	.0321	.1166	.9410
43	2.75	-28.35	1.0002	.0343	.0996	.9477
44	2.98	-28.37	.9943	.0307	.1166	.9419
45	3.23	-28.35	.9874	.0314	.1174	.9409
46	3.48	-28.60	.9970	.0260	.1171	.9438

TABLE A18 SPANWISE PROBE DATA UPPER PLANE
$\beta_1 = 28.12°$ Re = 495000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	8.02	-2.82	.8947	.1273	.1236	.8919
2	7.52	-2.42	.9026	.1259	.1135	.8972
3	7.02	-1.99	.9118	.1235	.1067	.9009
4	6.52	-2.00	.9163	.1251	.1043	.9024
5	6.02	-1.97	.9109	.1238	.1088	.9007
6	5.52	-1.99	.9181	.1208	.1051	.9040
7	5.02	-1.68	.9082	.1238	.1127	.8989
8	4.51	-1.68	.9024	.1257	.1200	.8947
9	4.01	-1.70	.9107	.1262	.1114	.8987
10	3.51	-1.69	.9062	.1232	.1179	.8969
11	3.01	-1.68	.9105	.1265	.1087	.8996
12	2.50	-1.95	.9100	.1244	.1119	.8991
13	2.00	-2.43	.8936	.1185	.1328	.8917

TABLE A19 SPANWISE PROBE DATA LOWER PLANE
$\beta_1 = 28.12°$ Re = 495000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.83	-27.71	1.0062	.0323	.1043	.9469
2	-2.38	-27.72	1.0039	.0274	.1095	.9467
3	-1.88	-27.71	1.0328	.0227	.0842	.9605
4	-1.38	-27.70	1.0379	.0209	.0805	.9630
5	-.90	-27.72	1.0325	.0183	.0891	.9603
6	-.38	-27.87	1.0278	.0225	.0889	.9585
7	.13	-27.96	1.0086	.0195	.1087	.9506
8	.65	-27.95	1.0129	.0179	.1098	.9511
9	1.14	-28.11	1.0053	.0173	.1137	.9493
10	1.64	-28.10	1.0088	.0140	.1153	.9502
11	2.18	-28.11	.9997	.0316	.1056	.9463
12	2.70	-28.38	1.0018	.0185	.1200	.9461
13	3.18	-28.48	.9986	.0191	.1215	.9450

TABLE A20 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 28.12° Re = 495000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	.9916	1.0259	.0147	.0066
.0160	.0019	-1.3002	-1.5858	.2490	.1107
.0319	.0066	-1.0086	-1.2536	.2323	.1033
.0479	.0112	-.3380	-.4893	.1888	.0841
.0858	.0215	-.2556	-.3955	.1828	.0815
.1218	.0303	-.1758	-.3046	.1768	.0788
.1956	.0452	-.0294	-.1377	.1653	.0737
.2695	.0576	.1484	.0649	.1502	.0670
.3433	.0663	.1536	.0709	.1497	.0668
.4192	.0716	.1445	.0604	.1505	.0672
.4930	.0736	.1209	.0336	.1526	.0681
.5669	.0727	.1209	.0336	.1526	.0681
.6407	.0678	.1601	.0783	.1491	.0665
.7146	.0601	.1667	.0858	.1485	.0663
.7884	.0487	.1654	.0843	.1487	.0663
.8283	.0411	.1798	.1007	.1474	.0658
.8683	.0327	.1798	.1007	.1474	.0658
.9082	.0230	.1458	.0619	.1504	.0671
.9481	.0123	.0739	-.0200	.1567	.0699
.9880	.0006	-.1745	-.3031	.1767	.0788
SUCTION SIDE CENTER BLADE					
.0160	.0227	.1262	.0396	.1521	.0679
.0319	.0310	-.0373	-.1467	.1659	.0740
.0479	.0389	-.1144	-.2346	.1721	.0767
.0858	.0563	-.3249	-.4744	.1878	.0837
.1218	.0710	-.4752	-.6458	.1984	.0884
.1956	.0970	-.7249	-.9303	.2149	.0956
.2695	.1170	-.9459	-1.1821	.2285	.1017
.3433	.1309	-.9642	-1.2030	.2296	.1021
.4192	.1399	-.8661	-1.0912	.2237	.0995
.4930	.1432	-.7851	-.9988	.2186	.0973
.5669	.1412	-.6949	-.8960	.2129	.0948
.6407	.1339	-.4569	-.6249	.1971	.0878
.7146	.1209	-.3366	-.4878	.1887	.0841
.7884	.1021	-.1915	-.3225	.1780	.0794
.8283	.0895	-.1536	-.2793	.1751	.0781
.8683	.0755	.0150	-.0871	.1616	.0721
.9082	.0593	-.0098	-.1154	.1637	.0730
.9481	.0407	-.0896	-.2062	.1701	.0759
.9880	.0206	-.1262	-.2480	.1730	.0771

TABLE A21 BLADE-TO-BLADE PROBE DATA UPPER PLANE AT MIDSPAN
β_1 = 32.95° Re = 630000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	M/Mref
1	-8.38	-1.57	.8414	.1764	.0964	.8334
2	-8.16	-1.59	.8376	.1758	.1017	.8313
3	-7.88	-1.58	.7349	.1827	.2002	.7786
4	-7.67	-1.57	.6395	.1892	.2877	.7274
5	-7.42	-1.91	.7985	.1793	.1365	.8123
6	-7.14	-1.90	.8418	.1731	.0924	.8362
7	-6.90	-1.61	.8365	.1775	.0932	.8336
8	-6.65	-1.60	.8382	.1789	.0884	.8350
9	-6.18	-1.61	.8365	.1741	.0875	.8370
10	-5.70	-1.59	.8234	.1832	.0947	.8293
11	-5.45	-1.57	.8170	.1792	.1029	.8270
12	-5.17	-1.84	.8087	.1737	.1173	.8227
13	-4.95	-1.77	.7000	.1826	.2185	.7657
14	-4.70	-1.76	.6279	.1860	.2914	.7244
15	-4.47	-1.85	.7901	.1738	.1324	.8146
16	-4.23	-1.82	.8357	.1682	.0944	.8366
17	-3.96	-1.83	.8358	.1685	.0936	.8368
18	-3.74	-1.80	.8328	.1710	.0912	.8364
19	-3.50	-1.82	.8282	.1755	.0926	.8335
20	-3.26	-1.82	.8266	.1772	.0939	.8322
21	-2.73	-1.44	.8210	.1791	.0976	.8295
22	-2.51	-1.45	.8264	.1726	.0945	.8337
23	-2.26	-1.45	.8186	.1665	.1083	.8300
24	-2.02	-1.44	.7226	.1792	.1984	.7782
25	-1.91	-1.43	.6562	.1854	.2612	.7412
26	-1.81	-1.45	.6485	.1844	.2676	.7377
27	-1.71	-1.42	.7155	.1822	.2038	.7739
28	-1.61	-1.70	.7783	.1786	.1445	.8067
29	-1.52	-2.08	.8088	.1746	.1133	.8238
30	-1.42	-2.05	.8292	.1706	.0976	.8337
31	-1.32	-1.88	.8341	.1748	.0931	.8344
32	-1.23	-1.90	.8304	.1739	.0976	.8326
33	-1.12	-1.88	.8280	.1734	.0989	.8320
34	-1.03	-1.47	.8281	.1766	.0988	.8308
35	-.93	-1.76	.8264	.1738	.1016	.8307
36	-.83	-1.76	.8237	.1772	.1030	.8285
37	-.73	-1.75	.8256	.1777	.1035	.8284
38	-.64	-1.75	.8252	.1800	.1024	.8279
39	-.54	-1.73	.8327	.1795	.0955	.8315
40	-.30	-1.75	.8266	.1784	.0998	.8296
41	-.01	-1.75	.8256	.1849	.0947	.8289
42	.19	-1.46	.8289	.1823	.0952	.8301
43	.45	-1.72	.8341	.1836	.0944	.8306
44	.70	-1.40	.8225	.1825	.1043	.8259
45	.94	-1.41	.7243	.1894	.2036	.7732
46	1.21	-1.43	.6353	.1941	.2883	.7246

TABLE A22 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN

β_1 = 32.95° Re = 630000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-6.99	-32.64	1.0092	.0132	.0884	.9144
2	-6.75	-32.66	.9999	.0139	.0980	.9098
3	-6.50	-32.90	1.0037	.0127	.0963	.9112
4	-6.24	-32.88	1.0272	.0150	.0671	.9228
5	-5.99	-32.63	1.0233	.0116	.0748	.9210
6	-5.74	-32.61	1.0049	.0091	.0900	.9152
7	-5.49	-32.65	.9904	.0091	.1046	.9088
8	-5.24	-32.88	.9875	.0134	.1017	.9080
9	-4.75	-32.49	.9772	.0081	.1099	.9064
10	-4.25	-32.86	1.0043	.0135	.0798	.9175
11	-4.01	-32.63	1.0115	.0089	.0747	.9218
12	-3.75	-32.64	.9893	.0114	.0953	.9115
13	-3.50	-32.91	.9922	.0086	.0949	.9129
14	-3.27	-32.90	1.0014	.0127	.0846	.9158
15	-3.01	-32.64	.9944	.0113	.0865	.9153
16	-2.77	-32.62	.9775	.0075	.1104	.9065
17	-2.52	-33.16	.9845	.0091	.1013	.9098
18	-2.26	-32.88	1.0048	.0074	.0791	.9203
19	-2.01	-32.88	.9969	.0090	.0870	.9162
20	-1.76	-32.98	.9789	.0126	.1030	.9074
21	-1.27	-32.98	.9998	.0109	.0833	.9170
22	-1.02	-32.88	.9870	.0096	.0937	.9128
23	-.78	-32.89	.9781	.0044	.1077	.9089
24	-.52	-33.13	.9915	.0103	.0932	.9129
25	-.42	-33.38	.9915	.0114	.0937	.9122
26	-.33	-33.14	.9992	.0091	.0857	.9167
27	-.23	-33.14	.9891	.0123	.0950	.9112
28	-.14	-33.12	.9957	.0127	.0888	.9139
29	-.03	-32.99	.9822	.0083	.1027	.9094
30	.07	-33.11	.9888	.0075	.0979	.9120
31	.17	-33.12	.9850	.0132	.1008	.9083
32	.26	-33.26	.9868	.0122	.0998	.9092
33	.37	-33.39	.9893	.0117	.0960	.9111
34	.47	-33.34	1.0053	.0120	.0827	.9170
35	.58	-33.14	1.0110	.0094	.0775	.9203
36	.66	-33.23	1.0090	.0130	.0782	.9185
37	.77	-33.12	1.0078	.0145	.0807	.9168
38	.86	-33.13	1.0019	.0144	.0876	.9138
39	.97	-33.13	1.0004	.0176	.0862	.9131
40	1.22	-33.38	.9779	.0118	.1121	.9040
41	1.49	-33.38	.9915	.0155	.0948	.9100
42	1.71	-33.24	1.0072	.0117	.0838	.9167
43	1.96	-33.40	.9984	.0167	.0937	.9103
44	2.21	-33.39	.9940	.0148	.0969	.9096
45	2.45	-33.51	1.0067	.0169	.0883	.9128
46	2.71	-33.38	1.0134	.0166	.0809	.9161

TABLE A23 SPANWISE PROBE DATA UPPER PLANE

β_1 = 32.95° Re = 630000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	7.97	-2.94	.8339	.1865	.1126	.8230
2	7.47	-2.38	.8406	.1919	.1023	.8255
3	6.98	-2.35	.8487	.1835	.1031	.8293
4	6.48	-1.79	.8523	.1861	.1015	.8294
5	5.99	-1.80	.8557	.1834	.0994	.8315
6	5.48	-1.68	.8535	.1841	.1009	.8305
7	4.99	-1.69	.8628	.1824	.0938	.8347
8	4.49	-1.21	.8556	.1882	.0978	.8303
9	3.99	-1.21	.8588	.1854	.0967	.8321
10	3.49	-1.52	.8651	.1813	.0978	.8339
11	2.99	-2.42	.8760	.1757	.0936	.8387
12	2.49	-1.85	.8652	.1793	.1023	.8331
13	1.99	-2.35	.7392	.1807	.2308	.7699

TABLE A24 SPANWISE PROBE DATA LOWER PLANE

β_1 = 32.95° Re = 630000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.88	-32.39	1.0097	.0262	.1048	.9027
2	-2.42	-32.49	1.0256	.0192	.0960	.9096
3	-1.92	-32.36	1.0266	.0170	.0975	.9100
4	-1.42	-32.49	1.0296	.0154	.0967	.9111
5	-.94	-32.61	1.0247	.0151	.1030	.9085
6	-.42	-32.63	1.0228	.0136	.1077	.9072
7	.08	-32.74	1.0228	.0137	.1096	.9065
8	.61	-32.91	1.0201	.0137	.1131	.9050
9	1.10	-32.90	1.0265	.0098	.1112	.9076
10	1.60	-33.14	1.0320	.0100	.1065	.9095
11	2.13	-33.13	1.0325	.0101	.1070	.9093
12	2.64	-33.19	1.0294	.0099	.1121	.9073
13	3.15	-33.14	1.0260	.0084	.1164	.9061

TABLE A25 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 32.95° Re = 630000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	.9852	1.0118	.0250	.0112
.0160	.0019	-.6975	-1.0613	.2729	.1212
.0319	.0066	-.1793	-.4228	.2263	.1007
.0479	.0112	-.1601	-.3992	.2244	.0999
.0858	.0215	-.1241	-.3548	.2208	.0983
.1218	.0303	-.0745	-.2937	.2158	.0961
.1956	.0452	.0663	-.1203	.2009	.0895
.2695	.0576	.1910	.0334	.1868	.0832
.3433	.0663	.2038	.0492	.1852	.0826
.4192	.0716	.1830	.0235	.1877	.0836
.4930	.0736	.1454	-.0228	.1920	.0856
.5669	.0727	.1470	-.0208	.1918	.0855
.6407	.0678	.1918	.0344	.1867	.0832
.7146	.0601	.1966	.0403	.1861	.0829
.7884	.0487	.2022	.0472	.1854	.0826
.8283	.0411	.2150	.0630	.1839	.0820
.8683	.0327	.2182	.0669	.1835	.0818
.9082	.0230	.1822	.0226	.1878	.0837
.9481	.0123	.1063	-.0710	.1965	.0875
.9880	.0006	-.1441	-.3795	.2228	.0992
SUCTION SIDE CENTER BLADE					
.0160	.0227	-.2377	-.4947	.2320	.1032
.0319	.0310	-.3376	-.6179	.2414	.1073
.0479	.0389	-.3616	-.6475	.2436	.1083
.0858	.0563	-.5216	-.8445	.2579	.1146
.1218	.0710	-.6240	-.9707	.2667	.1185
.1956	.0970	-.8263	-1.2199	.2834	.1258
.2695	.1170	-.9895	-1.4210	.2963	.1314
.3433	.1309	-.9607	-1.3855	.2941	.1304
.4192	.1399	-.8415	-1.2387	.2847	.1263
.4930	.1432	-.7223	-1.0919	.2750	.1221
.5669	.1412	-.5776	-.9135	.2628	.1167
.6407	.1339	-.4256	-.7263	.2494	.1109
.7146	.1209	-.2936	-.5637	.2373	.1055
.7884	.1021	-.1641	-.4041	.2248	.1000
.8283	.0895	-.1177	-.3469	.2202	.0980
.8683	.0755	.0391	-.1538	.2038	.0908
.9082	.0593	.0223	-.1745	.2057	.0916
.9481	.0407	-.0537	-.2681	.2137	.0951
.9880	.0206	-.0881	-.3105	.2172	.0967

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-8.33	-1.48	.8247	.1787	.1030	.8401
2	-8.11	-1.48	.8267	.1789	.1014	.8409
3	-7.84	-1.46	.7334	.1743	.2007	.7921
4	-7.59	-1.47	.6402	.1759	.2912	.7406
5	-7.37	-1.65	.7859	.1749	.1444	.8208
6	-7.12	-1.64	.8352	.1737	.0960	.8460
7	-6.87	-1.65	.8357	.1743	.0986	.8449
8	-6.62	-1.66	.8369	.1756	.0910	.8474
9	-6.13	-1.64	.8396	.1792	.0902	.8466
10	-5.64	-1.66	.8296	.1782	.0974	.8430
11	-5.39	-1.65	.8213	.1765	.1069	.8390
12	-5.14	-1.66	.8159	.1769	.1136	.8357
13	-4.90	-1.69	.7274	.1686	.2086	.7903
14	-4.64	-1.69	.6314	.1691	.3057	.7362
15	-4.42	-2.18	.7904	.1685	.1494	.8221
16	-4.18	-2.20	.8409	.1701	.0930	.8492
17	-3.93	-1.51	.8401	.1712	.0896	.8500
18	-3.69	-1.51	.8401	.1709	.0949	.8481
19	-3.45	-1.51	.8396	.1752	.0974	.8455
20	-2.96	-1.50	.8357	.1733	.1008	.8444
21	-2.71	-1.51	.8389	.1755	.1022	.8435
22	-2.46	-1.59	.8361	.1787	.1052	.8408
23	-2.21	-1.51	.8339	.1770	.1097	.8395
24	-1.96	-1.10	.7527	.1750	.1926	.7981
25	-1.86	-1.11	.6810	.1755	.2671	.7584
26	-1.76	-1.10	.6671	.1773	.2855	.7486
27	-1.66	-1.65	.7299	.1789	.2222	.7824
28	-1.57	-2.20	.8049	.1779	.1479	.8213
29	-1.47	-2.19	.8358	.1794	.1158	.8366
30	-1.37	-1.05	.8507	.1779	.1035	.8435
31	-1.27	-2.20	.8545	.1795	.0955	.8464
32	-1.17	-1.65	.8473	.1795	.1041	.8423
33	-1.07	-1.71	.8491	.1837	.1038	.8411
34	-.98	-1.70	.8496	.1827	.1055	.8409
35	-.88	-1.70	.8463	.1849	.1072	.8391
36	-.78	-1.71	.8488	.1846	.1055	.8401
37	-.69	-1.98	.8491	.1884	.1041	.8392
38	-.59	-1.89	.8519	.1847	.1047	.8407
39	-.49	-1.89	.8521	.1836	.1074	.8402
40	-.25	-1.92	.8559	.1826	.1083	.8407
41	0.00	-1.90	.8528	.1878	.1035	.8401
42	.24	-1.90	.8572	.1867	.0991	.8427
43	.49	-1.90	.8608	.1864	.0977	.8437
44	.74	-1.90	.8467	.1854	.1178	.8351
45	.99	-1.90	.7673	.1853	.1973	.7954
46	1.49	-1.89	.8252	.1840	.1423	.8240

TABLE A27 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN

β_1 = 32.87° Re = 474000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-6.97	-32.38	.9790	.0296	.0960	.9162
2	-6.73	-32.38	.9721	.0288	.1044	.9128
3	-6.48	-32.86	.9843	.0261	.0952	.9183
4	-6.24	-32.62	.9955	.0291	.0790	.9242
5	-5.97	-32.37	1.0047	.0254	.0726	.9288
6	-5.74	-32.48	.9800	.0230	.1002	.9173
7	-5.48	-32.49	.9721	.0225	.1122	.9122
8	-5.24	-32.63	.9778	.0253	.0988	.9168
9	-4.74	-32.36	.9689	.0238	.1148	.9104
10	-4.24	-32.64	.9933	.0263	.0838	.9233
11	-4.00	-32.62	1.0017	.0236	.0773	.9275
12	-3.75	-32.61	.9867	.0251	.0927	.9198
13	-3.51	-32.63	.9835	.0214	.0969	.9195
14	-3.25	-32.87	.9990	.0210	.0824	.9264
15	-3.00	-32.61	.9965	.0163	.0932	.9238
16	-2.77	-32.63	.9724	.0173	.1128	.9141
17	-2.50	-32.98	.9804	.0184	.1005	.9191
18	-2.26	-32.62	.9979	.0160	.0902	.9252
19	-2.00	-32.88	.9959	.0233	.0913	.9216
20	-1.51	-32.86	.9919	.0181	.0980	.9209
21	-1.26	-32.87	1.0076	.0192	.0879	.9252
22	-1.00	-32.87	.9966	.0230	.0985	.9188
23	-.76	-32.87	.9902	.0183	.1103	.9157
24	-.51	-33.11	.9972	.0201	.1002	.9194
25	-.41	-33.12	1.0023	.0221	.0957	.9206
26	-.31	-33.12	1.0023	.0238	.1002	.9181
27	-.22	-32.99	1.0120	.0266	.0893	.9218
28	-.12	-32.99	1.0062	.0257	.0966	.9190
29	-.02	-32.97	1.0002	.0239	.1049	.9161
30	.07	-32.96	1.0044	.0225	.1035	.9174
31	.17	-32.97	.9986	.0228	.1063	.9159
32	.27	-32.96	1.0035	.0186	.1069	.9176
33	.37	-33.13	1.0074	.0227	.1047	.9170
34	.48	-33.12	1.0178	.0236	.0943	.9213
35	.58	-33.12	1.0260	.0248	.0854	.9247
36	.67	-33.11	1.0291	.0253	.0823	.9259
37	.77	-33.11	1.0226	.0279	.0890	.9219
38	.91	-32.85	1.0249	.0228	.0915	.9231
39	.98	-32.86	1.0135	.0251	.1027	.9172
40	1.22	-33.25	1.0047	.0223	.1180	.9118
41	1.47	-33.22	1.0138	.0254	.1030	.9169
42	1.72	-33.22	1.0275	.0215	.0918	.9236
43	1.97	-33.23	1.0166	.0239	.1024	.9179
44	2.22	-33.23	1.0184	.0231	.1063	.9168
45	2.47	-33.22	1.0300	.0262	.0907	.9222
46	2.97	-33.22	1.0097	.0221	.1175	.9124

TABLE A28 SPANWISE PROBE DATA UPPER PLANE

β_1 = 32.87° Re = 474000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	7.99	-3.32	.8651	.1910	.1219	.8340
2	7.49	-2.59	.8684	.1992	.1085	.8362
3	6.99	-2.18	.8736	.1966	.1130	.8362
4	6.50	-2.17	.8801	.1905	.1110	.8399
5	6.01	-1.82	.8768	.1978	.1096	.8374
6	5.50	-1.82	.8775	.1982	.1063	.8385
7	5.00	-1.82	.8813	.1931	.1054	.8410
8	4.50	-1.81	.8752	.1958	.1144	.8362
9	4.00	-1.79	.8809	.1928	.1035	.8418
10	3.50	-1.82	.8847	.1951	.0996	.8428
11	3.00	-1.81	.8839	.1909	.0996	.8442
12	2.50	-2.15	.8717	.1957	.1163	.8351
13	2.00	-2.25	.7079	.1748	.2937	.7558

TABLE A29 SPANWISE PROBE DATA LOWER PLANE

β_1 = 32.87° Re = 474000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.86	-32.38	1.0262	.0313	.1152	.9105
2	-2.49	-32.37	1.0486	.0270	.0951	.9211
3	-1.90	-32.22	1.0435	.0213	.1071	.9185
4	-1.40	-32.23	1.0416	.0181	.1096	.9186
5	-.91	-32.12	1.0414	.0161	.1113	.9188
6	-.40	-32.60	1.0383	.0175	.1135	.9172
7	.11	-32.48	1.0383	.0156	.1160	.9170
8	.62	-32.62	1.0384	.0177	.1149	.9166
9	1.12	-32.62	1.0387	.0180	.1174	.9156
10	1.62	-32.61	1.0416	.0142	.1149	.9182
11	2.15	-32.98	1.0411	.0136	.1155	.9182
12	2.68	-32.99	1.0415	.0163	.1130	.9181
13	3.16	-32.99	1.0389	.0116	.1183	.9177

TABLE A30 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 32.87° Re = 474000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	.9917	1.0218	.0144	.0064
.0160	.0019	-.5693	-.8595	.1989	.0886
.0319	.0066	-.2151	-.4327	.1747	.0779
.0479	.0112	-.0679	-.2553	.1636	.0730
.0858	.0215	-.0652	-.2519	.1634	.0729
.1218	.0303	-.0124	-.1883	.1593	.0710
.1956	.0452	.0987	-.0544	.1502	.0670
.2695	.0576	.2459	.1230	.1373	.0613
.3433	.0663	.2487	.1263	.1370	.0612
.4192	.0716	.2293	.1029	.1388	.0619
.4930	.0736	.2057	.0745	.1409	.0629
.5669	.0727	.2029	.0711	.1412	.0630
.6407	.0678	.2404	.1163	.1378	.0615
.7146	.0601	.2445	.1213	.1374	.0613
.7884	.0487	.2473	.1247	.1371	.0612
.8283	.0411	.2584	.1381	.1361	.0608
.8683	.0327	.2584	.1381	.1361	.0608
.9082	.0230	.2348	.1096	.1383	.0617
.9481	.0123	.1501	.0075	.1458	.0651
.9880	.0006	-.0638	-.2502	.1633	.0728
SUCTION SIDE CENTER BLADE					
.0160	.0227	-.1638	-.3707	.1709	.0762
.0319	.0310	-.2582	-.4845	.1778	.0793
.0479	.0389	-.2846	-.5163	.1797	.0801
.0858	.0563	-.4318	-.6938	.1899	.0846
.1218	.0710	-.5290	-.8109	.1963	.0875
.1956	.0970	-.7123	-1.0318	.2080	.0926
.2695	.1170	-.8720	-1.2243	.2176	.0969
.3433	.1309	-.8498	-1.1975	.2163	.0963
.4192	.1399	-.7429	-1.0687	.2098	.0934
.4930	.1432	-.6346	-.9381	.2031	.0905
.5669	.1412	-.5026	-.7791	.1946	.0867
.6407	.1339	-.3526	-.5984	.1845	.0822
.7146	.1209	-.2207	-.4394	.1751	.0781
.7884	.1021	-.0971	-.2904	.1659	.0740
.8283	.0895	-.0568	-.2419	.1628	.0726
.8683	.0755	.0987	-.0544	.1502	.0670
.9082	.0593	.0807	-.0762	.1517	.0677
.9481	.0407	.0029	-.1699	.1581	.0705
.9880	.0206	-.0290	-.2084	.1606	.0716

TABLE A31 BLADE-TO-BLADE PROBE DATA UPPER PLANE AT MIDSPAN

β_1 = 38.91° Re = 676000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-8.51	-2.05	.6744	.2918	.0868	.6977
2	-8.31	-2.05	.6646	.2895	.0993	.6926
3	-8.06	-2.05	.5611	.2938	.2025	.6359
4	-7.81	-2.05	.5080	.2950	.2543	.6054
5	-7.56	-2.24	.6306	.2884	.1370	.6741
6	-7.31	-2.82	.6809	.2905	.0845	.7001
7	-7.05	-2.82	.6813	.2920	.0819	.7005
8	-6.79	-2.82	.6793	.2903	.0852	.6996
9	-6.26	-2.82	.6720	.2924	.0889	.6964
10	-5.80	-2.82	.6630	.2934	.0987	.6912
11	-5.52	-2.82	.6590	.2961	.1018	.6886
12	-5.25	-2.10	.6313	.2922	.1330	.6743
13	-5.04	-2.10	.5460	.2945	.2164	.6276
14	-4.79	-2.09	.4894	.2957	.2733	.5941
15	-4.54	-2.51	.6162	.2896	.1498	.6666
16	-4.29	-2.47	.6771	.2864	.0907	.6988
17	-4.05	-2.47	.6783	.2873	.0897	.6990
18	-3.55	-2.46	.6745	.2933	.0870	.6972
19	-3.27	-2.47	.6704	.2972	.0897	.6943
20	-3.05	-2.48	.6692	.2939	.0914	.6946
21	-2.80	-2.47	.6703	.2929	.0919	.6950
22	-2.53	-2.47	.6765	.2907	.0889	.6978
23	-2.29	-2.47	.6579	.2870	.1112	.6884
24	-2.19	-1.94	.6254	.2882	.1407	.6719
25	-2.08	-1.94	.5791	.2921	.1876	.6455
26	-1.98	-1.94	.5269	.2937	.2395	.6157
27	-1.88	-1.95	.5004	.2957	.2643	.6001
28	-1.77	-2.05	.5137	.2924	.2510	.6089
29	-1.67	-2.18	.5631	.2894	.1970	.6408
30	-1.57	-3.08	.6223	.2882	.1466	.6694
31	-1.47	-3.08	.6634	.2844	.1067	.6917
32	-1.37	-2.87	.6792	.2861	.0920	.6988
33	-1.27	-2.51	.6829	.2866	.0886	.7004
34	-1.02	-2.51	.6799	.2856	.0901	.6997
35	-.77	-2.49	.6847	.2859	.0862	.7018
36	-.53	-2.77	.6817	.2872	.0874	.7004
37	-.27	-2.77	.6818	.2870	.0871	.7006
38	.01	-2.77	.6803	.2901	.0892	.6986
39	.23	-2.41	.6840	.2933	.0850	.6996
40	.49	-2.43	.6795	.2913	.0914	.6974
41	.75	-2.07	.6607	.2910	.1120	.6873
42	1.00	-2.07	.5700	.2928	.2052	.6378
43	1.25	-2.07	.5102	.2952	.2616	.6040
44	1.51	-3.34	.6315	.2891	.1454	.6715
45	1.76	-3.07	.6903	.2855	.0890	.7020
46	2.02	-3.05	.6905	.2857	.0878	.7024

TABLE A32 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN

β_1 = 38.91° Re = .676000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-7.05	-38.60	.9895	-.0238	.0811	.8463
2	-6.80	-38.60	.9812	-.0221	.0880	.8446
3	-6.54	-38.71	.9886	-.0224	.0831	.8468
4	-6.30	-38.71	1.0033	-.0237	.0687	.8533
5	-6.04	-38.60	.9990	-.0238	.0736	.8514
6	-5.79	-38.60	.9809	-.0190	.0880	.8434
7	-5.52	-38.60	.9722	-.0223	.0995	.8400
8	-5.28	-38.60	.9803	-.0254	.0940	.8436
9	-4.78	-38.34	.9698	-.0236	.1012	.8398
10	-4.27	-38.71	.9847	-.0254	.0895	.8455
11	-4.02	-38.60	.9968	-.0232	.0766	.8499
12	-3.77	-38.60	.9913	-.0248	.0830	.8480
13	-3.53	-38.86	.9836	-.0238	.0891	.8450
14	-3.28	-38.85	.9923	-.0233	.0805	.8483
15	-3.01	-38.60	.9889	-.0245	.0839	.8474
16	-2.78	-38.80	.9808	-.0237	.0910	.8441
17	-2.52	-38.85	.9826	-.0272	.0938	.8445
18	-1.99	-38.84	.9852	-.0236	.0870	.8458
19	-1.74	-38.96	.9858	-.0249	.0901	.8451
20	-1.50	-39.12	.9903	-.0265	.0843	.8481
21	-1.25	-38.85	.9975	-.0260	.0770	.8509
22	-.99	-38.85	.9893	-.0269	.0874	.8470
23	-.75	-38.85	.9868	-.0286	.0914	.8461
24	-.64	-39.11	.9828	-.0277	.0923	.8453
25	-.54	-39.10	.9948	-.0273	.0834	.8489
26	-.45	-39.10	.9986	-.0282	.0812	.8502
27	-.35	-39.11	1.0042	-.0274	.0745	.8526
28	-.25	-38.96	.9915	-.0265	.0834	.8485
29	-.14	-38.96	.9925	-.0275	.0816	.8496
30	-.05	-38.95	.9878	-.0257	.0880	.8463
31	.05	-38.96	.9908	-.0283	.0855	.8484
32	.15	-38.97	.9863	-.0263	.0911	.8453
33	.25	-39.21	.9904	-.0268	.0883	.8466
34	.50	-39.10	1.0063	-.0302	.0729	.8544
35	.76	-39.08	1.0106	-.0291	.0687	.8557
36	1.02	-38.96	1.0026	-.0302	.0773	.8526
37	1.26	-39.10	.9962	-.0325	.0859	.8500
38	1.55	-39.30	1.0010	-.0315	.0835	.8506
39	1.78	-39.30	1.0042	-.0299	.0815	.8509
40	2.02	-39.32	.9979	-.0289	.0868	.8483
41	2.28	-39.35	1.0029	-.0307	.0847	.8499
42	2.55	-39.35	1.0085	-.0284	.0797	.8511
43	2.78	-39.35	1.0073	-.0289	.0795	.8513
44	3.05	-39.21	.9928	-.0288	.0950	.8449
45	3.28	-39.30	.9928	-.0305	.0964	.8451
46	3.53	-39.34	1.0009	-.0314	.0883	.8488

TABLE A33 SPANWISE PROBE DATA UPPER PLANE
β_1 = 38.91° Re = 676000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	7.99	-3.62	.4949	.2898	.3022	.5897
2	7.49	-3.43	.6089	.2919	.1819	.6546
3	7.00	-2.99	.6734	.2975	.1086	.6888
4	6.50	-2.97	.6880	.3004	.0935	.6953
5	6.00	-2.95	.6874	.3001	.0963	.6944
6	5.50	-2.61	.6898	.2984	.0930	.6964
7	5.00	-2.60	.6905	.2981	.0912	.6972
8	4.50	-2.60	.6921	.2983	.0908	.6976
9	4.00	-2.47	.6938	.2949	.0924	.6985
10	3.50	-2.47	.6971	.2937	.0883	.7008
11	2.99	-2.78	.6989	.2933	.0891	.7009
12	2.49	-2.77	.6511	.2897	.1419	.6766
13	1.99	-4.62	.4533	.2873	.3425	.5656

TABLE A34 SPANWISE PROBE DATA LOWER PLANE
β_1 = 38.91° Re = 676000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.93	-38.85	.9970	-.0152	.0961	.8392
2	-2.46	-38.85	.9981	-.0199	.0970	.8408
3	-1.95	-38.70	1.0107	-.0232	.0852	.8470
4	-1.43	-38.72	1.0061	-.0240	.0933	.8440
5	-.93	-38.78	1.0058	-.0259	.0973	.8432
6	-.41	-38.79	1.0069	-.0279	.0958	.8446
7	.11	-38.89	1.0076	-.0275	.0932	.8455
8	.64	-38.96	1.0164	-.0300	.0881	.8486
9	1.15	-39.21	1.0146	-.0301	.0900	.8479
10	1.66	-39.21	1.0121	-.0308	.0912	.8476
11	2.19	-39.21	1.0189	-.0299	.0857	.8496
12	2.73	-39.21	1.0075	-.0302	.0983	.8446
13	3.21	-38.85	1.0023	-.0307	.1019	.8433

TABLE A35 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 38.91° Re = 676000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	.4720	.2407	.1565	.0698
.0160	.0019	.1887	-.1904	.1946	.0867
.0319	.0066	.2547	-.0900	.1864	.0831
.0479	.0112	.2480	-.1002	.1872	.0834
.0858	.0215	.2339	-.1216	.1890	.0842
.1218	.0303	.2436	-.1069	.1878	.0837
.1956	.0452	.2814	-.0494	.1830	.0815
.2695	.0576	.3734	.0906	.1707	.0761
.3433	.0663	.3949	.1233	.1677	.0748
.4192	.0716	.3704	.0860	.1711	.0763
.4930	.0736	.3318	.0274	.1763	.0786
.5669	.0727	.3177	.0059	.1782	.0794
.6407	.0678	.3511	.0567	.1737	.0775
.7146	.0601	.3422	.0432	.1749	.0780
.7884	.0487	.3600	.0702	.1725	.0769
.8283	.0411	.3771	.0962	.1702	.0759
.8683	.0327	.3763	.0951	.1703	.0759
.9082	.0230	.2985	-.0234	.1807	.0806
.9481	.0123	.2866	-.0415	.1823	.0813
.9880	.0006	.1323	-.2762	.2014	.0897
SUCTION SIDE CENTER BLADE					
.0160	.0227	-.7072	-1.5536	.2850	.1264
.0319	.0310	-.5292	-1.2828	.2692	.1195
.0479	.0389	-.5017	-1.2410	.2667	.1184
.0858	.0563	-.5314	-1.2862	.2694	.1196
.1218	.0710	-.5485	-1.3121	.2710	.1203
.1956	.0970	-.6174	-1.4171	.2771	.1230
.2695	.1170	-.6708	-1.4983	.2818	.1251
.3433	.1309	-.5855	-1.3686	.2743	.1218
.4192	.1399	-.4520	-1.1654	.2621	.1164
.4930	.1432	-.3475	-1.0063	.2522	.1121
.5669	.1412	-.2266	-.8224	.2403	.1069
.6407	.1339	-.1102	-.6452	.2284	.1016
.7146	.1209	-.0086	-.4906	.2174	.0968
.7884	.1021	.0738	-.3653	.2082	.0927
.8283	.0895	.1027	-.3213	.2048	.0912
.8683	.0755	.2666	-.0719	.1849	.0824
.9082	.0593	.2592	-.0832	.1858	.0828
.9481	.0407	.1576	-.2378	.1984	.0884
.9880	.0206	.1642	-.2277	.1976	.0880

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-8.51	-2.37	.6869	.2920	.0925	.7071
2	-8.32	-2.37	.6734	.2923	.1078	.6995
3	-8.05	-2.36	.5740	.2877	.2094	.6470
4	-7.81	-2.38	.5222	.2874	.2638	.6166
5	-7.56	-2.38	.6394	.2898	.1438	.6819
6	-7.31	-2.36	.6889	.2919	.0908	.7080
7	-7.05	-2.37	.6888	.2940	.0865	.7087
8	-6.55	-2.37	.6895	.2935	.0887	.7083
9	-6.03	-2.38	.6862	.2949	.0889	.7072
10	-5.77	-2.39	.6812	.2943	.0955	.7043
11	-5.55	-2.38	.6748	.2939	.1042	.7004
12	-5.29	-2.38	.6604	.2918	.1202	.6931
13	-5.02	-2.38	.5539	.2872	.2334	.6347
14	-4.79	-2.39	.5101	.2830	.2788	.6100
15	-4.54	-2.38	.6323	.2893	.1537	.6775
16	-4.29	-2.39	.6881	.2932	.0930	.7068
17	-4.04	-2.38	.6916	.2937	.0879	.7089
18	-3.79	-2.38	.6909	.2933	.0891	.7085
19	-3.29	-2.38	.6895	.2922	.0906	.7081
20	-3.05	-2.38	.6862	.2931	.0947	.7059
21	-2.80	-2.38	.6831	.2958	.0955	.7042
22	-2.51	-2.38	.6879	.2934	.0923	.7069
23	-2.28	-2.37	.6723	.2882	.1127	.6991
24	-2.19	-2.39	.6447	.2901	.1423	.6835
25	-2.08	-2.38	.5922	.2879	.1962	.6555
26	-1.98	-2.38	.5438	.2867	.2465	.6282
27	-1.88	-2.39	.5183	.2844	.2759	.6129
28	-1.78	-2.38	.5295	.2862	.2623	.6196
29	-1.67	-2.38	.5763	.2879	.2159	.6456
30	-1.57	-2.37	.6345	.2925	.1562	.6762
31	-1.47	-2.38	.6740	.2913	.1151	.6976
32	-1.37	-2.39	.6882	.2919	.1003	.7048
33	-1.27	-2.38	.6951	.2930	.0920	.7084
34	-1.02	-2.39	.6939	.2932	.0959	.7069
35	-.77	-2.38	.6961	.2939	.0930	.7080
36	-.52	-2.39	.6960	.2965	.0933	.7070
37	-.27	-2.38	.6962	.2947	.0935	.7076
38	-.01	-2.38	.6979	.2944	.0959	.7072
39	.23	-2.38	.7026	.2960	.0911	.7091
40	.49	-2.38	.6985	.2931	.0952	.7080
41	.74	-2.38	.6845	.2917	.1136	.7000
42	1.00	-2.39	.5902	.2853	.2129	.6508
43	1.28	-2.38	.5332	.2874	.2700	.6183
44	1.51	-2.38	.6432	.2889	.1578	.6787
45	1.76	-2.38	.7052	.2938	.0920	.7100
46	2.02	-2.39	.7046	.2978	.0896	.7093

TABLE A37 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN

β_1 = 38.89° Re = 530000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-7.04	-38.48	.9933	-.0099	.0843	.8521
2	-6.80	-38.49	.9848	-.0088	.0938	.8477
3	-6.55	-38.48	.9902	-.0094	.0855	.8513
4	-6.28	-38.73	1.0054	-.0075	.0702	.8570
5	-6.05	-38.36	1.0046	-.0105	.0746	.8565
6	-5.79	-38.46	.9832	-.0091	.0940	.8477
7	-5.53	-38.47	.9774	-.0107	.0991	.8461
8	-5.03	-38.46	.9792	-.0100	.0989	.8460
9	-4.54	-38.48	.9735	-.0104	.1035	.8441
10	-4.26	-38.61	.9910	-.0103	.0865	.8513
11	-4.03	-38.62	.9985	-.0106	.0811	.8538
12	-3.78	-38.62	.9953	-.0117	.0848	.8527
13	-3.53	-38.61	.9888	-.0114	.0923	.8495
14	-3.27	-38.74	.9949	-.0113	.0831	.8532
15	-3.02	-38.73	.9886	-.0088	.0913	.8488
16	-2.76	-38.74	.9837	-.0104	.0974	.8469
17	-2.51	-38.85	.9834	-.0125	.0989	.8472
18	-2.26	-38.85	.9963	-.0118	.0850	.8527
19	-1.76	-38.86	.9865	-.0118	.0940	.8488
20	-1.50	-39.11	.9904	-.0126	.0925	.8499
21	-1.24	-38.86	.9990	-.0111	.0826	.8534
22	-.98	-38.86	.9950	-.0114	.0862	.8520
23	-.74	-38.85	.9874	-.0130	.0950	.8490
24	-.65	-38.86	.9894	-.0133	.0969	.8484
25	-.55	-39.11	.9913	-.0131	.0935	.8497
26	-.46	-39.11	1.0015	-.0152	.0855	.8540
27	-.35	-39.11	1.0074	-.0158	.0816	.8559
28	-.25	-39.10	1.0045	-.0121	.0804	.8548
29	-.14	-38.72	1.0067	-.0158	.0843	.8549
30	-.05	-38.85	1.0028	-.0120	.0879	.8518
31	.06	-38.85	1.0007	-.0142	.0899	.8519
32	.15	-38.86	.9933	-.0130	.0964	.8486
33	.26	-39.10	.9988	-.0151	.0928	.8511
34	.51	-39.11	1.0159	-.0163	.0794	.8572
35	.78	-38.86	1.0208	-.0169	.0750	.8592
36	1.01	-38.86	1.0204	-.0170	.0782	.8580
37	1.28	-38.85	1.0005	-.0172	.0974	.8502
38	1.52	-39.21	1.0147	-.0196	.0891	.8547
39	1.78	-39.21	1.0175	-.0173	.0855	.8553
40	2.03	-39.11	1.0110	-.0192	.0911	.8537
41	2.28	-39.35	1.0193	-.0184	.0847	.8560
42	2.53	-39.37	1.0247	-.0207	.0794	.8591
43	2.78	-39.35	1.0178	-.0181	.0855	.8556
44	3.04	-39.22	1.0050	-.0190	.0995	.8501
45	3.27	-39.21	1.0010	-.0173	.1037	.8478
46	3.54	-39.22	1.0125	-.0159	.0915	.8522

TABLE A38 SPANWISE PROBE DATA UPPER PLANE

$\beta_1 = 38.89°$ Re = 530000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	7.99	-3.65	.5341	.2814	.2842	.6163
2	7.49	-3.34	.6320	.2915	.1786	.6691
3	6.99	-3.03	.6898	.2967	.1111	.7002
4	6.49	-3.01	.7022	.2973	.0973	.7066
5	6.00	-2.77	.7026	.3000	.0971	.7059
6	5.49	-2.76	.7021	.2991	.0966	.7063
7	5.00	-2.38	.7035	.2986	.0966	.7067
8	4.49	-2.38	.7064	.2969	.0937	.7087
9	3.99	-2.38	.7082	.2974	.0934	.7089
10	3.49	-2.69	.7095	.2952	.0927	.7101
11	2.99	-2.69	.7062	.2949	.0975	.7080
12	2.49	-3.07	.6386	.2862	.1718	.6743
13	2.00	-4.32	.4461	.2694	.3862	.5631

TABLE A39 SPANWISE PROBE DATA LOWER PLANE

$\beta_1 = 38.89°$ Re = 530000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.96	-38.59	.9946	-.0036	.1036	.8423
2	-2.48	-38.60	1.0128	-.0082	.0929	.8487
3	-1.97	-38.46	1.0075	-.0108	.0971	.8480
4	-1.46	-38.46	1.0050	-.0124	.1005	.8472
5	-.96	-38.60	1.0113	-.0128	.0973	.8488
6	-.44	-38.85	1.0098	-.0158	.1000	.8489
7	.07	-38.96	1.0130	-.0159	.0978	.8499
8	.60	-39.04	1.0090	-.0148	.0990	.8489
9	1.10	-39.21	1.0135	-.0141	.0958	.8499
10	1.63	-39.36	1.0203	-.0174	.0905	.8534
11	2.17	-39.36	1.0209	-.0168	.0905	.8532
12	2.69	-39.35	1.0182	-.0179	.0917	.8531
13	3.18	-39.35	1.0053	-.0163	.1067	.8464

TABLE A40 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 38.89° Re = 530000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	.4845	.2768	.1212	.0541
.0160	.0019	.1897	-.1639	.1522	.0679
.0319	.0066	.2504	-.0732	.1463	.0653
.0479	.0112	.2407	-.0877	.1473	.0657
.0858	.0215	.2383	-.0913	.1475	.0658
.1218	.0303	.2468	-.0786	.1467	.0655
.1956	.0452	.2832	-.0242	.1431	.0639
.2695	.0576	.3535	.0810	.1358	.0606
.3433	.0663	.3948	.1426	.1314	.0586
.4192	.0716	.3656	.0991	.1345	.0600
.4930	.0736	.3244	.0374	.1389	.0620
.5669	.0727	.3135	.0211	.1400	.0625
.6407	.0678	.3390	.0592	.1373	.0613
.7146	.0601	.3353	.0538	.1377	.0615
.7884	.0487	.3523	.0792	.1359	.0607
.8283	.0411	.3669	.1009	.1344	.0600
.8683	.0327	.3656	.0991	.1345	.0600
.9082	.0230	.2868	-.0188	.1427	.0637
.9481	.0123	.2771	-.0333	.1437	.0641
.9880	.0006	.1315	-.2509	.1576	.0703
SUCTION SIDE CENTER BLADE					
.0160	.0227	-1.1010	-2.0936	.2472	.1099
.0319	.0310	-.5114	-1.2122	.2088	.0930
.0479	.0389	-.4981	-1.1922	.2079	.0926
.0858	.0563	-.5478	-1.2666	.2114	.0941
.1218	.0710	-.5709	-1.3010	.2130	.0948
.1956	.0970	-.6340	-1.3953	.2173	.0967
.2695	.1170	-.6825	-1.4679	.2206	.0982
.3433	.1309	-.6036	-1.3500	.2152	.0958
.4192	.1399	-.4763	-1.1596	.2063	.0919
.4930	.1432	-.3683	-.9982	.1985	.0884
.5669	.1412	-.2421	-.8095	.1890	.0842
.6407	.1339	-.1281	-.6390	.1800	.0802
.7146	.1209	-.0225	-.4813	.1712	.0763
.7884	.1021	.0612	-.3561	.1640	.0731
.8283	.0895	.0903	-.3126	.1614	.0720
.8683	.0755	.2589	-.0605	.1455	.0649
.9082	.0593	.2565	-.0641	.1457	.0650
.9481	.0407	.1424	-.2346	.1566	.0699
.9880	.0206	.1509	-.2219	.1558	.0695

TABLE A41 BLADE-TO-BLADE PROBE DATA UPPER PLANE AT MIDSPAN
β_1 = 42.90° Re = 686000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-8.48	-1.63	.6268	.3055	.1121	.6579
2	-8.27	-1.63	.5630	.3055	.1792	.6230
3	-8.03	-1.62	.4547	.3118	.2819	.5604
4	-7.78	-1.62	.4796	.3095	.2607	.5750
5	-7.53	-1.63	.6102	.3032	.1302	.6496
6	-7.27	-1.62	.6579	.3033	.0856	.6731
7	-7.01	-1.63	.6600	.3070	.0829	.6731
8	-6.51	-3.12	.6527	.3102	.0829	.6707
9	-6.01	-2.41	.6464	.3076	.0907	.6678
10	-5.76	-2.40	.6354	.3307	.1028	.6546
11	-5.48	-2.39	.6038	.3050	.1398	.6447
12	-5.23	-2.39	.5300	.3051	.2100	.6055
13	-5.00	-2.39	.4522	.3131	.2858	.5581
14	-4.74	-2.40	.4791	.3185	.2590	.5728
15	-4.50	-2.39	.6019	.3077	.1378	.6440
16	-4.26	-2.40	.6471	.3021	.0956	.6682
17	-4.02	-2.40	.6518	.3061	.0874	.6704
18	-3.52	-3.01	.6446	.3127	.0876	.6668
19	-3.26	-2.57	.6456	.3112	.0902	.6667
20	-3.01	-2.58	.6407	.3082	.0950	.6652
21	-2.77	-2.58	.6415	.3071	.0950	.6657
22	-2.50	-2.58	.6155	.3048	.1264	.6514
23	-2.41	-2.58	.5902	.3048	.1524	.6378
24	-2.31	-2.57	.5540	.3237	.1859	.6134
25	-2.21	-2.57	.5057	.3080	.2336	.5910
26	-2.11	-2.58	.4619	.3153	.2765	.5633
27	-2.01	-2.57	.4393	.3106	.2988	.5508
28	-1.90	-2.57	.4432	.3184	.2925	.5518
29	-1.80	-2.57	.4795	.3074	.2589	.5760
30	-1.70	-2.57	.5332	.3128	.2063	.6052
31	-1.60	-2.57	.5840	.3042	.1573	.6351
32	-1.50	-2.57	.6260	.3180	.1176	.6522
33	-1.24	-2.57	.6520	.3256	.0894	.6636
34	-1.00	-3.63	.6526	.3019	.0900	.6711
35	-.75	-2.58	.6510	.3129	.0916	.6668
36	-.50	-2.56	.6470	.3068	.0901	.6684
37	-.25	-2.58	.6444	.3195	.0925	.6631
38	0.00	-2.56	.6432	.3047	.0936	.6672
39	.25	-2.58	.6350	.3075	.1062	.6608
40	.51	-2.57	.6156	.3025	.1267	.6520
41	.76	-2.57	.5198	.3076	.2221	.5984
42	1.02	-2.57	.4466	.3079	.2915	.5560
43	1.27	-2.57	.4895	.3145	.2530	.5788
44	1.54	-2.56	.6166	.2977	.1281	.6533
45	1.78	-2.57	.6511	.3046	.0928	.6691
46	2.04	-2.58	.6518	.2999	.0904	.6715

TABLE A42 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN

β_1 = 42.90° Re = 686000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-7.02	-42.56	.9952	-.0393	.0811	.8324
2	-6.79	-42.81	.9917	-.0385	.0860	.8301
3	-6.54	-42.81	1.0063	-.0394	.0713	.8364
4	-6.29	-42.80	1.0101	-.0384	.0681	.8373
5	-6.03	-42.42	1.0034	-.0401	.0723	.8363
6	-5.78	-42.29	.9892	-.0374	.0881	.8288
7	-5.54	-42.66	.9777	-.0348	.1004	.8228
8	-5.01	-42.56	.9811	-.0384	.0963	.8259
9	-4.54	-42.82	.9831	-.0391	.0938	.8272
10	-4.29	-42.82	.9981	-.0163	.0795	.8240
11	-4.05	-42.81	.9956	-.0373	.0823	.8311
12	-3.80	-42.54	.9910	-.0399	.0852	.8310
13	-3.54	-42.66	.9903	-.0355	.0866	.8287
14	-3.30	-42.67	.9912	-.0288	.0847	.8267
15	-3.04	-42.67	.9785	-.0345	.0959	.8244
16	-2.79	-42.68	.9787	-.0381	.0973	.8253
17	-2.54	-42.81	.9839	-.0389	.0935	.8272
18	-2.04	-42.81	.9878	-.0362	.0861	.8290
19	-1.78	-42.80	.9872	-.0380	.0908	.8280
20	-1.53	-42.81	.9923	-.0402	.0845	.8314
21	-1.29	-43.07	.9887	-.0375	.0853	.8299
22	-1.03	-42.94	.9833	-.0389	.0949	.8267
23	-.94	-42.94	.9879	-.0398	.0912	.8286
24	-.85	-42.94	.9912	-.0214	.0852	.8237
25	-.74	-43.18	.9893	-.0376	.0864	.8295
26	-.63	-43.07	.9919	-.0330	.0852	.8283
27	-.53	-43.06	.9962	-.0387	.0811	.8322
28	-.43	-43.05	.9929	-.0312	.0823	.8286
29	-.34	-43.06	.9948	-.0393	.0806	.8326
30	-.25	-43.04	.9928	-.0323	.0830	.8288
31	-.14	-43.06	.9898	-.0387	.0863	.8300
32	-.04	-43.06	.9914	-.0236	.0864	.8241
33	.21	-43.32	.9944	-.0153	.0808	.8230
34	.47	-43.17	1.0035	-.0392	.0729	.8357
35	.70	-43.18	.9977	-.0301	.0806	.8289
36	.96	-43.16	.9898	-.0388	.0859	.8303
37	1.22	-43.17	.9954	-.0272	.0809	.8276
38	1.46	-43.31	.9933	-.0390	.0801	.8326
39	1.72	-43.09	.9930	-.0346	.0829	.8298
40	2.01	-43.31	.9871	-.0355	.0856	.8290
41	2.21	-43.57	.9864	-.0317	.0859	.8273
42	2.47	-43.56	.9867	-.0372	.0867	.8292
43	2.73	-43.31	.9772	-.0264	.0973	.8207
44	2.96	-43.55	.9737	-.0389	.1004	.8243
45	3.21	-43.57	.9788	-.0319	.0948	.8238
46	3.46	-43.57	.9809	-.0375	.0918	.8273

TABLE A43 SPANWISE PROBE DATA UPPER PLANE

β_1 = 42.90° Re = 686000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	7.99	-4.72	.3161	.3116	.4306	.4657
2	7.49	-3.11	.4224	.3040	.3262	.5392
3	7.00	-2.56	.5451	.3020	.2032	.6125
4	6.50	-2.57	.6070	.3099	.1356	.6451
5	6.00	-2.58	.6432	.3062	.0980	.6654
6	5.50	-2.56	.6453	.3088	.0952	.6659
7	5.00	-2.57	.6473	.3061	.0928	.6679
8	4.50	-2.58	.6466	.3050	.0922	.6683
9	4.00	-2.57	.6466	.3047	.0943	.6677
10	3.50	-2.58	.6267	.3051	.1157	.6569
11	3.00	-2.56	.5694	.3014	.1745	.6273
12	2.49	-4.17	.4545	.3037	.2896	.5604
13	1.99	-5.55	.3521	.2987	.3942	.4945

TABLE A44 SPANWISE PROBE DATA LOWER PLANE

β_1 = 42.90° Re = 686000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.94	-43.06	.9602	-.0223	.1100	.8137
2	-2.47	-42.81	.9776	-.0310	.0962	.8229
3	-1.96	-42.80	.9816	-.0346	.0949	.8249
4	-1.45	-42.81	.9763	-.0332	.1020	.8215
5	-.96	-42.81	.9841	-.0385	.0948	.8266
6	-.41	-42.80	.9755	-.0340	.1010	.8222
7	.10	-42.88	.9887	-.0372	.0876	.8289
8	.64	-43.07	.9921	-.0393	.0839	.8313
9	1.13	-43.06	.9945	-.0393	.0832	.8316
10	1.64	-43.33	.9987	-.0383	.0795	.8327
11	2.19	-43.31	1.0032	-.0436	.0771	.8358
12	2.73	-43.32	.9822	-.0381	.0942	.8266
13	3.20	-43.07	.9752	-.0422	.1017	.8252

TABLE A45 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 42.90° Re = 686000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
********	********	********	********	********	********
PRESSURE SIDE CENTER BLADE					
.0007	.0054	-.0738	-.6829	.2304	.1025
.0160	.0019	.5532	.3413	.1476	.0659
.0319	.0066	.4995	.2536	.1563	.0697
.0479	.0112	.4551	.1810	.1632	.0728
.0858	.0215	.4007	.0922	.1712	.0763
.1218	.0303	.3936	.0806	.1722	.0768
.1956	.0452	.4000	.0910	.1713	.0764
.2695	.0576	.4565	.1833	.1630	.0727
.3433	.0663	.4777	.2179	.1597	.0712
.4192	.0716	.4508	.1741	.1638	.0731
.4930	.0736	.4063	.1014	.1704	.0760
.5669	.0727	.3901	.0749	.1727	.0770
.6407	.0678	.4120	.1106	.1696	.0756
.7146	.0601	.4049	.0991	.1706	.0761
.7884	.0487	.4176	.1199	.1687	.0753
.8283	.0411	.4289	.1383	.1671	.0745
.8683	.0327	.4219	.1268	.1681	.0750
.9082	.0230	.3993	.0899	.1714	.0764
.9481	.0123	.3378	-.0105	.1801	.0803
.9880	.0006	.1966	-.2411	.1987	.0885
SUCTION SIDE CENTER BLADE					
.0160	.0227	-1.5799	-3.1430	.3634	.1604
.0319	.0310	-.8025	-1.8732	.3010	.1334
.0479	.0389	-.5652	-1.4856	.2797	.1241
.0858	.0563	-.5250	-1.4199	.2760	.1225
.1218	.0710	-.5186	-1.4095	.2754	.1222
.1956	.0970	-.5201	-1.4118	.2755	.1223
.2695	.1170	-.5165	-1.4060	.2752	.1221
.3433	.1309	-.4184	-1.2457	.2658	.1181
.4192	.1399	-.2885	-1.0335	.2530	.1124
.4930	.1432	-.1832	-.8617	.2422	.1077
.5669	.1412	-.0724	-.6806	.2302	.1024
.6407	.1339	.0258	-.5203	.2192	.0976
.7146	.1209	.1055	-.3899	.2099	.0934
.7884	.1021	.1606	-.3000	.2032	.0905
.8283	.0895	.1839	-.2619	.2003	.0892
.8683	.0755	.3117	-.0532	.1837	.0819
.9082	.0593	.3075	-.0601	.1842	.0821
.9481	.0407	.2206	-.2019	.1956	.0872
.9880	.0206	.2298	-.1869	.1945	.0866

TABLE A46 BLADE-TO-BLADE PROBE DATA UPPER PLANE AT MIDSPAN

β_1 = 42.92° Re 583000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-8.52	-2.87	.6416	.3102	.1072	.6685
2	-8.28	-2.86	.5744	.3047	.1786	.6333
3	-8.02	-2.86	.4573	.3108	.2946	.5642
4	-7.78	-2.88	.4895	.3092	.2624	.5840
5	-7.52	-2.87	.5989	.3116	.1533	.6446
6	-7.26	-2.89	.6523	.3122	.0899	.6754
7	-7.01	-2.89	.6523	.3201	.0895	.6730
8	-6.51	-2.88	.6605	.3191	.0838	.6767
9	-6.01	-2.88	.6500	.3109	.0966	.6732
10	-5.76	-2.89	.6473	.3165	.0997	.6700
11	-5.51	-2.88	.6096	.3194	.1395	.6489
12	-5.26	-2.88	.5631	.3117	.1927	.6242
13	-5.00	-2.88	.4465	.3073	.3093	.5575
14	-4.75	-2.88	.4706	.3070	.2877	.5716
15	-4.51	-2.88	.6046	.3124	.1470	.6476
16	-4.23	-2.89	.6410	.3172	.1019	.6678
17	-4.01	-2.89	.6580	.3198	.0875	.6748
18	-3.52	-2.87	.6438	.3182	.1015	.6682
19	-3.27	-2.87	.6347	.3207	.1070	.6638
20	-3.02	-2.89	.6489	.3120	.0960	.6729
21	-2.76	-2.88	.6384	.3175	.1083	.6652
22	-2.51	-2.86	.6167	.3117	.1354	.6541
23	-2.41	-2.89	.6025	.3112	.1543	.6453
24	-2.31	-2.88	.5539	.3022	.2026	.6217
25	-2.21	-2.88	.4977	.3084	.2611	.5872
26	-2.11	-2.88	.4787	.3080	.2797	.5762
27	-2.00	-2.89	.4517	.3069	.3091	.5595
28	-1.90	-2.89	.4456	.3109	.3141	.5550
29	-1.80	-2.89	.4850	.3114	.2720	.5794
30	-1.70	-2.88	.5201	.3089	.2376	.6003
31	-1.60	-2.89	.5823	.3103	.1741	.6349
32	-1.50	-2.88	.6296	.3077	.1329	.6589
33	-1.25	-2.88	.6417	.3225	.1087	.6642
34	-1.00	-2.88	.6588	.3166	.0930	.6743
35	-.75	-2.88	.6548	.3145	.0997	.6721
36	-.50	-2.89	.6583	.3192	.0966	.6723
37	-.25	-2.88	.6511	.3239	.1011	.6680
38	0.00	-2.88	.6509	.3176	.1009	.6700
39	.25	-2.88	.6307	.3153	.1301	.6576
40	.53	-2.86	.6114	.3102	.1488	.6493
41	.76	-2.88	.5356	.3094	.2344	.6056
42	1.02	-2.89	.4495	.3099	.3159	.5562
43	1.27	-2.88	.4993	.3111	.2664	.5856
44	1.53	-2.88	.6309	.3051	.1372	.6587
45	1.79	-2.88	.6616	.3156	.1023	.6723
46	2.04	-2.88	.6615	.3164	.0970	.6737

TABLE A47 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN
β_1 = 42.92° Re = 583000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-7.04	-42.57	.9979	-.0296	.0856	.8361
2	-6.78	-42.82	.9929	-.0270	.0860	.8348
3	-6.54	-42.81	1.0006	-.0196	.0748	.8353
4	-6.30	-42.82	.9987	-.0178	.0736	.8360
5	-6.03	-42.56	.9974	-.0197	.0805	.8341
6	-5.79	-42.57	.9839	-.0231	.0889	.8319
7	-5.54	-42.57	.9885	-.0268	.0954	.8310
8	-5.05	-42.56	.9844	-.0233	.0977	.8286
9	-4.53	-42.56	.9843	-.0275	.0960	.8309
10	-4.28	-42.68	1.0021	-.0287	.0850	.8360
11	-4.05	-42.68	.9875	-.0118	.0875	.8281
12	-3.79	-42.67	.9982	-.0231	.0864	.8332
13	-3.54	-42.81	.9869	-.0215	.0909	.8305
14	-3.30	-42.81	.9922	-.0215	.0879	.8319
15	-3.02	-42.81	.9850	-.0190	.0928	.8288
16	-2.80	-42.82	.9838	-.0206	.0922	.8296
17	-2.54	-42.93	.9913	-.0185	.0877	.8307
18	-2.03	-42.80	.9886	-.0232	.0932	.8304
19	-1.79	-42.81	.9881	-.0216	.0909	.8306
20	-1.53	-42.82	.9923	-.0249	.0846	.8344
21	-1.29	-42.93	.9892	-.0208	.0907	.8304
22	-1.03	-42.91	.9889	-.0204	.0901	.8305
23	-.93	-42.94	.9925	-.0225	.0926	.8305
24	-.82	-43.07	.9896	-.0248	.0881	.8330
25	-.75	-43.07	.9928	-.0234	.0915	.8312
26	-.63	-43.06	1.0010	-.0276	.0862	.8351
27	-.54	-43.08	1.0056	-.0325	.0877	.8366
28	-.45	-43.07	.9944	-.0203	.0897	.8308
29	-.33	-43.07	1.0012	-.0250	.0854	.8344
30	-.24	-43.07	.9952	-.0228	.0880	.8324
31	-.14	-43.07	.9920	-.0229	.0919	.8308
32	-.04	-43.07	1.0047	-.0322	.0924	.8346
33	.20	-43.06	1.0051	-.0231	.0856	.8337
34	.46	-43.17	1.0145	-.0282	.0769	.8392
35	.70	-43.18	1.0155	-.0330	.0811	.8395
36	.97	-43.07	1.0114	-.0313	.0889	.8358
37	1.22	-43.32	1.0026	-.0263	.0948	.8314
38	1.48	-43.32	1.0081	-.0289	.0850	.8362
39	1.72	-43.32	1.0113	-.0269	.0862	.8351
40	1.98	-43.31	1.0088	-.0323	.0883	.8363
41	2.22	-43.32	1.0112	-.0266	.0885	.8341
42	2.48	-43.33	1.0013	-.0228	.0899	.8318
43	2.75	-43.32	.9911	-.0220	.1013	.8269
44	2.96	-43.32	.9935	-.0325	.1070	.8289
45	3.21	-43.57	.9936	-.0204	.1015	.8263
46	3.46	-43.43	1.0064	-.0309	.0944	.8334

TABLE A48 SPANWISE PROBE DATA UPPER PLANE
β_1 = 42.92° Re = 583000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	8.00	-3.54	.3771	.3179	.4330	.4978
2	7.49	-2.42	.5113	.3238	.2964	.5782
3	7.00	-2.41	.6149	.3334	.1864	.6326
4	6.50	-2.42	.6774	.3330	.1212	.6645
5	6.00	-2.41	.6888	.3360	.1039	.6709
6	5.50	-2.42	.6871	.3361	.1059	.6699
7	5.00	-2.43	.6896	.3347	.1018	.6720
8	4.49	-2.43	.6954	.3350	.0986	.6740
9	3.99	-2.43	.6903	.3345	.1008	.6725
10	3.49	-2.44	.6776	.3394	.1122	.6653
11	2.99	-2.43	.6030	.3225	.1963	.6301
12	2.49	-3.38	.5067	.3136	.3041	.5774
13	2.00	-4.48	.3880	.3089	.4238	.5066

TABLE A49 SPANWISE PROBE DATA UPPER PLANE
β_1 = 42.92° Re = 583000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.94	-43.20	1.0303	-.0186	.1084	.8243
2	-2.47	-42.70	1.0347	-.0158	.1055	.8244
3	-1.96	-42.82	1.0427	-.0175	.1033	.8261
4	-1.45	-42.83	1.0490	-.0312	.1082	.8295
5	-.96	-42.97	1.0518	-.0317	.1030	.8316
6	-.42	-42.97	1.0525	-.0314	.1024	.8317
7	.10	-43.22	1.0576	-.0320	.0949	.8348
8	.62	-43.23	1.0608	-.0276	.0902	.8349
9	1.13	-43.48	1.0610	-.0260	.0849	.8363
10	1.65	-43.49	1.0653	-.0207	.0788	.8366
11	2.19	-43.49	1.0682	-.0347	.0815	.8410
12	2.71	-43.50	1.0658	-.0360	.0870	.8394
13	3.21	-43.48	1.0445	-.0368	.1049	.8327

TABLE A50 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 42.92° Re = 583000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	-.1674	-.8157	.2001	.0891
.0160	.0019	.5417	.3404	.1247	.0557
.0319	.0066	.4786	.2374	.1330	.0594
.0479	.0112	.4337	.1643	.1387	.0619
.0858	.0215	.3777	.0730	.1455	.0649
.1218	.0303	.3573	.0398	.1478	.0660
.1956	.0452	.3757	.0697	.1457	.0650
.2695	.0576	.4347	.1660	.1386	.0619
.3433	.0663	.4551	.1992	.1360	.0607
.4192	.0716	.4276	.1544	.1395	.0622
.4930	.0736	.3818	.0796	.1450	.0647
.5669	.0727	.3675	.0564	.1467	.0654
.6407	.0678	.3828	.0813	.1449	.0646
.7146	.0601	.3757	.0697	.1457	.0650
.7884	.0487	.3879	.0896	.1443	.0644
.8283	.0411	.4001	.1095	.1428	.0637
.8683	.0327	.3940	.0996	.1435	.0641
.9082	.0230	.3655	.0530	.1469	.0656
.9481	.0123	.3054	-.0450	.1538	.0686
.9880	.0006	.1648	-.2742	.1688	.0753
SUCTION SIDE CENTER BLADE					
.0160	.0227	-1.7354	-3.3719	.3101	.1373
.0319	.0310	-.8867	-1.9883	.2558	.1136
.0479	.0389	-.6360	-1.5797	.2377	.1057
.0858	.0563	-.6004	-1.5216	.2350	.1045
.1218	.0710	-.5851	-1.4967	.2339	.1040
.1956	.0970	-.6096	-1.5365	.2357	.1048
.2695	.1170	-.5953	-1.5133	.2347	.1044
.3433	.1309	-.4832	-1.3306	.2261	.1006
.4192	.1399	-.3528	-1.1180	.2157	.0960
.4930	.1432	-.2469	-.9452	.2069	.0921
.5669	.1412	-.1317	-.7575	.1969	.0877
.6407	.1339	-.0288	-.5898	.1876	.0836
.7146	.1209	.0568	-.4502	.1795	.0800
.7884	.1021	.1169	-.3522	.1736	.0774
.8283	.0895	.1383	-.3174	.1715	.0765
.8683	.0755	.2789	-.0881	.1567	.0699
.9082	.0593	.2758	-.0931	.1570	.0701
.9481	.0407	.1780	-.2526	.1674	.0747
.9880	.0206	.1862	-.2393	.1666	.0743

β1 = 45.96° Re = 690000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-8.47	-1.52	.4632	.3257	.2358	.5591
2	-8.27	-1.52	.3804	.3365	.3218	.5036
3	-8.02	-1.53	.3671	.3317	.3350	.4960
4	-7.77	-1.53	.4698	.3335	.2350	.5593
5	-7.52	-1.52	.5902	.3245	.1167	.6282
6	-7.27	-1.53	.6194	.3249	.0901	.6424
7	-7.01	-1.52	.6191	.3297	.0859	.6421
8	-6.50	-3.45	.5998	.3419	.0998	.6301
9	-6.01	-2.87	.5581	.3288	.1477	.6102
10	-5.76	-2.86	.5122	.3323	.1977	.5827
11	-5.51	-2.29	.4493	.3275	.2610	.5473
12	-5.25	-2.29	.3751	.3310	.3323	.5002
13	-5.00	-2.29	.3630	.3317	.3450	.4919
14	-4.75	-2.29	.4653	.3350	.2449	.5549
15	-4.51	-2.28	.5872	.3226	.1248	.6257
16	-4.26	-2.29	.6211	.3231	.0910	.6431
17	-4.01	-2.27	.6218	.3312	.0879	.6417
18	-3.51	-3.80	.6123	.3334	.0922	.6377
19	-3.26	-3.81	.6070	.3397	.1010	.6320
20	-3.00	-3.32	.5857	.3300	.1225	.6238
21	-2.76	-3.32	.5421	.3281	.1724	.5992
22	-2.51	-3.32	.4461	.3356	.2641	.5432
23	-2.41	-3.31	.4012	.3320	.3079	.5166
24	-2.31	-3.32	.3626	.3419	.3447	.4893
25	-2.21	-3.31	.3494	.3338	.3628	.4812
26	-2.11	-3.32	.3540	.3338	.3583	.4843
27	-2.00	-3.32	.3784	.3329	.3355	.5004
28	-1.90	-3.33	.4235	.3441	.2907	.5263
29	-1.80	-3.31	.4774	.3285	.2416	.5614
30	-1.70	-3.33	.5342	.3301	.1850	.5930
31	-1.60	-3.32	.5806	.3279	.1399	.6182
32	-1.50	-3.32	.6090	.3273	.1098	.6336
33	-1.25	-3.59	.6300	.3271	.0915	.6435
34	-1.00	-3.59	.6256	.3416	.0922	.6380
35	-.75	-3.59	.6226	.3317	.0924	.6403
36	-.50	-3.60	.6129	.3352	.1028	.6341
37	-.25	-3.59	.5900	.3347	.1268	.6221
38	.01	-3.58	.5475	.3297	.1766	.5990
39	.25	-3.59	.4943	.3290	.2317	.5692
40	.51	-3.59	.4166	.3361	.3059	.5220
41	.76	-3.59	.3637	.3355	.3602	.4878
42	1.02	-3.59	.3885	.3339	.3358	.5043
43	1.29	-3.59	.5202	.3501	.2075	.5775
44	1.53	-3.58	.6065	.3403	.1234	.6252
45	1.78	-3.57	.6328	.3270	.0922	.6439
46	2.04	-3.59	.6288	.3502	.0985	.6342

TABLE A52 BLADE-TO-BLADE PROBE DATA LOWER PLANE AT MIDSPAN

β_1 = 45.96° Re = 690000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-7.03	-45.80	.9874	-.0490	.0768	.8194
2	-6.77	-45.81	.9869	-.0445	.0859	.8141
3	-6.50	-45.81	.9879	-.0489	.0842	.8165
4	-6.27	-45.81	.9870	-.0443	.0860	.8140
5	-6.01	-45.80	1.0021	-.0486	.0696	.8222
6	-5.76	-45.81	.9938	-.0473	.0803	.8174
7	-5.50	-45.67	.9889	-.0478	.0860	.8154
8	-5.00	-45.68	.9758	-.0433	.1015	.8075
9	-4.49	-45.68	.9762	-.0489	.0992	.8106
10	-4.25	-45.67	.9756	-.0448	.1026	.8076
11	-4.00	-45.81	.9911	-.0495	.0864	.8160
12	-3.76	-45.82	.9950	-.0470	.0798	.8176
13	-3.51	-45.81	.9917	-.0473	.0846	.8158
14	-3.25	-45.81	.9825	-.0393	.0925	.8094
15	-3.01	-45.80	.9893	-.0498	.0870	.8158
16	-2.76	-45.82	.9887	-.0479	.0869	.8151
17	-2.50	-45.80	.9748	-.0431	.1019	.8072
18	-2.00	-45.91	.9864	-.0456	.0895	.8131
19	-1.75	-46.06	.9829	-.0398	.0971	.8079
20	-1.50	-46.06	.9870	-.0474	.0906	.8134
21	-1.24	-46.06	.9924	-.0465	.0880	.8142
22	-.99	-45.93	.9898	-.0443	.0904	.8123
23	-.89	-46.06	.9903	-.0469	.0874	.8145
24	-.79	-45.81	.9831	-.0388	.0944	.8086
25	-.71	-46.05	.9879	-.0447	.0922	.8118
26	-.60	-46.06	.9910	-.0463	.0905	.8131
27	-.50	-46.06	.9916	-.0458	.0904	.8130
28	-.40	-46.07	.9964	-.0344	.0860	.8103
29	-.31	-46.05	.9968	-.0468	.0878	.8144
30	-.21	-46.07	.9910	-.0432	.0928	.8110
31	-.10	-46.07	1.0031	-.0461	.0830	.8161
32	.01	-46.18	1.0042	-.0461	.0799	.8173
33	.23	-46.06	1.0009	-.0486	.0887	.8149
34	.51	-46.18	1.0041	-.0344	.0819	.8120
35	.75	-46.17	1.0086	-.0471	.0772	.8188
36	1.00	-46.19	1.0095	-.0457	.0789	.8176
37	1.26	-46.18	1.0070	-.0468	.0827	.8165
38	1.50	-46.17	1.0051	-.0467	.0864	.8150
39	1.76	-46.18	1.0075	-.0450	.0829	.8158
40	2.01	-46.18	1.0105	-.0454	.0829	.8160
41	2.26	-46.56	1.0048	-.0446	.0881	.8136
42	2.51	-46.32	1.0039	-.0452	.0888	.8136
43	2.75	-46.31	1.0052	-.0237	.0870	.8060
44	3.01	-46.31	1.0010	-.0311	.0922	.8068
45	3.25	-46.30	.9941	-.0439	.0943	.8108
46	3.51	-46.57	.9883	-.0220	.1038	.7988

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	8.00	-6.38	.2593	.3356	.4698	.4112
2	7.49	-3.10	.3013	.3385	.4279	.4425
3	7.00	-3.10	.3658	.3411	.3615	.4872
4	6.50	-3.09	.4483	.3359	.2776	.5405
5	6.00	-3.09	.5069	.3393	.2161	.5743
6	5.50	-2.57	.5533	.3355	.1716	.6003
7	5.00	-2.56	.5689	.3344	.1573	.6085
8	4.49	-2.57	.5852	.3345	.1385	.6177
9	4.00	-2.58	.5724	.3474	.1481	.6082
10	3.50	-2.56	.5366	.3351	.1829	.5928
11	3.00	-2.59	.4590	.3361	.2644	.5475
12	2.49	-3.10	.3579	.3331	.3740	.4827
13	1.99	-6.96	.3048	.3306	.4323	.4451

TABLE A54 SPANWISE PROBE DATA LOWER PLANE

β_1 = 45.96° Re = 690000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.94	-46.06	.9880	-.0336	.0989	.8050
2	-2.47	-45.93	.9997	-.0368	.0933	.8086
3	-1.95	-45.82	1.0114	-.0390	.0849	.8127
4	-1.44	-45.81	1.0121	-.0460	.0854	.8153
5	-.94	-45.81	1.0064	-.0435	.0899	.8125
6	-.42	-45.81	1.0102	-.0478	.0889	.8146
7	.10	-46.06	1.0037	-.0471	.0953	.8119
8	.63	-46.07	1.0041	-.0491	.0948	.8129
9	1.13	-46.07	.9955	-.0367	.1008	.8057
10	1.65	-46.33	1.0043	-.0508	.0920	.8145
11	2.17	-46.33	.9996	-.0473	.0973	.8111
12	2.70	-46.31	1.0123	-.0514	.0929	.8146
13	3.20	-45.93	1.0063	-.0505	.1004	.8113

β_1 = 45.96° Re = 690000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	-.3548	-1.3151	.2599	.1154
.0160	.0019	.6982	.5920	.1212	.0541
.0319	.0066	.5969	.4086	.1402	.0626
.0479	.0112	.5431	.3111	.1494	.0667
.0858	.0215	.4688	.1765	.1612	.0719
.1218	.0303	.4440	.1316	.1650	.0736
.1956	.0452	.4497	.1418	.1641	.0732
.2695	.0576	.4971	.2278	.1568	.0700
.3433	.0663	.5070	.2457	.1553	.0693
.4192	.0716	.4794	.1957	.1596	.0712
.4930	.0736	.4334	.1123	.1666	.0743
.5669	.0727	.4164	.0816	.1691	.0754
.6407	.0678	.4348	.1149	.1664	.0742
.7146	.0601	.4235	.0944	.1681	.0749
.7884	.0487	.4312	.1085	.1669	.0744
.8283	.0411	.4433	.1303	.1651	.0736
.8683	.0327	.4369	.1188	.1661	.0741
.9082	.0230	.4093	.0687	.1701	.0759
.9481	.0123	.3491	-.0403	.1787	.0797
.9880	.0006	.2124	-.2878	.1969	.0877
SUCTION SIDE CENTER BLADE					
.0160	.0227	-1.4977	-3.3851	.3575	.1579
.0319	.0310	-1.4439	-3.2876	.3534	.1561
.0479	.0389	-1.2456	-2.9285	.3380	.1495
.0858	.0563	-.6763	-1.8974	.2901	.1287
.1218	.0710	-.4844	-1.5498	.2724	.1209
.1956	.0970	-.4645	-1.5139	.2705	.1201
.2695	.1170	-.4263	-1.4447	.2669	.1185
.3433	.1309	-.3265	-1.2638	.2571	.1142
.4192	.1399	-.1976	-1.0304	.2439	.1084
.4930	.1432	-.1013	-.8560	.2336	.1039
.5669	.1412	-.0028	-.6777	.2227	.0991
.6407	.1339	.0786	-.5302	.2133	.0949
.7146	.1209	.1423	-.4148	.2056	.0916
.7884	.1021	.1891	-.3301	.1998	.0890
.8283	.0895	.2061	-.2993	.1977	.0881
.8683	.0755	.3349	-.0659	.1807	.0805
.9082	.0593	.3123	-.1070	.1838	.0819
.9481	.0407	.2351	-.2468	.1940	.0864
.9880	.0206	.2422	-.2339	.1931	.0860

TABLE A56 BLADE-TO-BLADE PROBE DATA UPPER PLANE AT MIDSPAN
β_1 = 45.90° Re = 506000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-8.48	-2.43	.4901	.3311	.2525	.5691
2	-8.27	-2.43	.4045	.3299	.3388	.5174
3	-8.02	-2.43	.4015	.3228	.3508	.5151
4	-7.77	-2.44	.5035	.3286	.2406	.5771
5	-7.52	-3.00	.5979	.3473	.1293	.6278
6	-7.23	-3.71	.6109	.3447	.1045	.6388
7	-7.00	-3.73	.6231	.3449	.0920	.6451
8	-6.50	-3.71	.6007	.3462	.1162	.6326
9	-6.00	-3.71	.5613	.3334	.1681	.6118
10	-5.74	-3.71	.5233	.3251	.2110	.5919
11	-5.50	-3.71	.4412	.3190	.3027	.5429
12	-5.25	-3.71	.3928	.3204	.3543	.5113
13	-5.00	-3.71	.3827	.3206	.3641	.5048
14	-4.75	-3.71	.4962	.3247	.2422	.5755
15	-4.50	-3.71	.5754	.3342	.1537	.6193
16	-4.26	-3.71	.6230	.3500	.0970	.6421
17	-3.76	-3.71	.6060	.3472	.1085	.6358
18	-3.51	-3.71	.6178	.3507	.1003	.6398
19	-3.25	-3.70	.5985	.3433	.1179	.6325
20	-3.00	-3.71	.6005	.3443	.1231	.6311
21	-2.76	-3.71	.5545	.3358	.1729	.6081
22	-2.51	-3.72	.4789	.3284	.2610	.5641
23	-2.41	-3.72	.4298	.3219	.3125	.5356
24	-2.30	-3.71	.3971	.3195	.3487	.5147
25	-2.21	-3.71	.3671	.3161	.3774	.4960
26	-2.10	-3.71	.3805	.3218	.3651	.5033
27	-2.00	-3.70	.3939	.3135	.3540	.5135
28	-1.90	-3.71	.4429	.3249	.2989	.5430
29	-1.80	-3.72	.4867	.3200	.2515	.5713
30	-1.70	-3.72	.5479	.3292	.1858	.6046
31	-1.59	-3.71	.5673	.3322	.1602	.6160
32	-1.50	-3.72	.6093	.3421	.1142	.6364
33	-1.25	-3.72	.6092	.3474	.1109	.6358
34	-.98	-3.72	.6066	.3476	.1127	.6346
35	-.74	-3.70	.6057	.3469	.1079	.6360
36	-.50	-3.72	.5937	.3389	.1236	.6310
37	-.25	-3.72	.5902	.3404	.1321	.6273
38	-.00	-3.72	.5184	.3252	.2124	.5901
39	.25	-3.72	.4847	.3264	.2517	.5689
40	.51	-3.71	.4360	.3191	.3082	.5396
41	.78	-3.71	.3688	.3149	.3821	.4959
42	1.04	-3.71	.4074	.3180	.3438	.5203
43	1.28	-3.72	.5099	.3262	.2328	.5818
44	1.53	-3.71	.5948	.3374	.1365	.6280
45	1.80	-3.72	.6080	.3436	.1172	.6348
46	2.04	-3.72	.6073	.3470	.1144	.6344

β_1 = 45.90° Re = 506000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/λref
1	-7.04	-45.82	1.0121	-.0292	.0851	.8196
2	-6.77	-45.81	.9979	-.0195	.0888	.8142
3	-6.52	-45.81	1.0130	-.0322	.0881	.8197
4	-6.26	-45.81	1.0105	-.0277	.0843	.8193
5	-5.98	-45.80	1.0073	-.0162	.0788	.8169
6	-5.76	-45.67	1.0077	-.0236	.0714	.8226
7	-5.51	-45.68	.9945	-.0238	.0851	.8171
8	-5.01	-45.67	.9846	-.0258	.1000	.8120
9	-4.50	-45.66	.9838	-.0256	.1000	.8119
10	-4.26	-45.42	.9850	-.0256	.0950	.8138
11	-4.01	-45.67	.9915	-.0250	.0908	.8154
12	-3.75	-45.67	.9953	-.0204	.0866	.8153
13	-3.51	-45.67	1.0018	-.0231	.0826	.8180
14	-3.26	-45.66	.9959	-.0231	.0851	.8169
15	-2.98	-45.67	.9945	-.0252	.0893	.8161
16	-2.76	-45.66	.9982	-.0222	.0896	.8149
17	-2.26	-45.77	.9960	-.0239	.0851	.8172
18	-2.00	-45.81	.9977	-.0289	.0955	.8152
19	-1.74	-45.65	.9910	-.0263	.0906	.8160
20	-1.49	-46.05	.9894	-.0227	.0968	.8122
21	-1.24	-46.05	.9924	-.0226	.0886	.8153
22	-1.00	-46.05	.9896	-.0190	.0923	.8124
23	-.90	-46.06	.9875	-.0195	.0906	.8132
24	-.80	-46.04	.9900	-.0221	.0915	.8139
25	-.70	-46.06	.9888	-.0263	.0920	.8153
26	-.60	-46.05	.9911	-.0197	.0900	.8136
27	-.50	-46.04	.9897	-.0262	.0920	.8153
28	-.39	-46.04	.9898	-.0204	.0918	.8132
29	-.30	-46.05	.9863	-.0254	.0920	.8149
30	-.21	-46.05	.9948	-.0257	.0888	.8165
31	-.10	-46.31	.9906	-.0222	.0866	.8159
32	-.01	-46.06	.9954	-.0196	.0853	.8155
33	.25	-46.06	.9907	-.0188	.0913	.8128
34	.49	-46.06	.9880	-.0191	.0935	.8120
35	.74	-46.05	.9944	-.0204	.0821	.8170
36	1.00	-46.06	.9871	-.0236	.0883	.8157
37	1.24	-46.06	.9937	-.0199	.0843	.8159
38	1.50	-46.06	.9933	-.0248	.0823	.8185
39	1.76	-46.17	.9935	-.0221	.0860	.8161
40	2.01	-46.30	.9927	-.0207	.0856	.8157
41	2.26	-46.30	.9865	-.0221	.0955	.8123
42	2.51	-46.30	.9945	-.0205	.0893	.8143
43	2.75	-46.31	.9989	-.0221	.0868	.8160
44	3.01	-46.55	.9906	-.0211	.0948	.8123
45	3.25	-46.43	.9887	-.0188	.0945	.8115
46	3.51	-46.44	.9796	-.0178	.1027	.8078

TABLE A58 SPANWISE PROBE DATA UPPER PLANE
β_1 = 45.90° Re = 506000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	7.99	-4.74	.2904	.3092	.4798	.4375
2	7.50	-4.36	.3334	.3089	.4290	.4705
3	7.01	-3.61	.3811	.3186	.3755	.5019
4	6.50	-2.69	.4819	.3309	.2616	.5642
5	6.00	-2.69	.5232	.3330	.2124	.5893
6	5.50	-2.69	.5565	.3418	.1793	.6051
7	5.00	-2.70	.5708	.3395	.1614	.6144
8	4.50	-2.71	.5713	.3404	.1597	.6148
9	4.00	-2.71	.5803	.3368	.1532	.6193
10	3.50	-2.71	.5090	.3298	.2300	.5812
11	2.99	-2.92	.4316	.3208	.3181	.5351
12	2.49	-3.51	.3570	.3101	.4046	.4866
13	1.99	-6.84	.3263	.3019	.4449	.4651

TABLE A59 SPANWISE PROBE DATA LOWER PLANE
β_1 = 45.90° Re = 506000

Point	Loc(in)	Beta	Q/Q1ref	ΔPs/Q1ref	ΔPt/Q1ref	X/Xref
1	-2.95	-45.81	.9874	-.0109	.0965	.8077
2	-2.48	-45.79	.9930	-.0186	.0908	.8130
3	-1.97	-45.79	.9986	-.0232	.0938	.8138
4	-1.44	-45.80	.9925	-.0199	.0965	.8113
5	-.95	-45.80	.9972	-.0211	.0873	.8153
6	-.44	-45.80	1.0009	-.0203	.0920	.8134
7	.10	-45.81	.9967	-.0213	.0915	.8138
8	.63	-46.06	.9969	-.0247	.0943	.8141
9	1.13	-46.06	1.0055	-.0287	.0908	.8172
10	1.64	-46.32	.9950	-.0237	.0923	.8144
11	2.18	-46.31	1.0003	-.0274	.0918	.8161
12	2.69	-46.32	.9963	-.0280	.0972	.8142
13	3.19	-46.08	.9931	-.0282	.1020	.8124

TABLE A60 INSTRUMENTED BLADE PRESSURE DATA

β_1 = 45.90° Re = 506000

X/C	Y/C	Cp1	Cp2	Mach	Xvel
PRESSURE SIDE CENTER BLADE					
.0007	.0054	-.3647	-1.3208	.1965	.0875
.0160	.0019	.6824	.5855	.0941	.0421
.0319	.0066	.5804	.3999	.1083	.0484
.0479	.0112	.5269	.3025	.1150	.0514
.0858	.0215	.4523	.1667	.1238	.0553
.1218	.0303	.4374	.1395	.1255	.0560
.1956	.0452	.4337	.1327	.1259	.0562
.2695	.0576	.4797	.2165	.1207	.0539
.3433	.0663	.4921	.2391	.1192	.0532
.4192	.0716	.4660	.1916	.1222	.0546
.4930	.0736	.4200	.1078	.1274	.0569
.5669	.0727	.4001	.0716	.1296	.0579
.6407	.0678	.4163	.1010	.1279	.0571
.7146	.0601	.4051	.0807	.1291	.0576
.7884	.0487	.4125	.0942	.1283	.0573
.8283	.0411	.4225	.1124	.1272	.0568
.8683	.0327	.4175	.1033	.1277	.0570
.9082	.0230	.3864	.0467	.1311	.0585
.9481	.0123	.3267	-.0620	.1374	.0613
.9880	.0006	.1999	-.2929	.1499	.0669
SUCTION SIDE CENTER BLADE					
.0160	.0227	-1.5523	-3.4829	.2708	.1202
.0319	.0310	-1.4963	-3.3810	.2677	.1189
.0479	.0389	-1.2165	-2.8716	.2518	.1119
.0858	.0563	-.5786	-1.7102	.2116	.0942
.1218	.0710	-.5002	-1.5676	.2062	.0918
.1956	.0970	-.4903	-1.5494	.2055	.0915
.2695	.1170	-.4605	-1.4951	.2034	.0906
.3433	.1309	-.3535	-1.3004	.1956	.0872
.4192	.1399	-.2254	-1.0672	.1860	.0829
.4930	.1432	-.1247	-.8838	.1781	.0794
.5669	.1412	-.0277	-.7072	.1701	.0759
.6407	.1339	.0581	-.5510	.1628	.0726
.7146	.1209	.1178	-.4423	.1575	.0703
.7884	.1021	.1626	-.3608	.1534	.0684
.8283	.0895	.1812	-.3269	.1516	.0677
.8683	.0755	.3205	-.0733	.1380	.0616
.9082	.0593	.3093	-.0937	.1392	.0621
.9481	.0407	.2123	-.2703	.1487	.0664
.9880	.0206	.2173	-.2612	.1482	.0661

APPENDIX B

A. STORAGE OF EXPERIMENTAL DATA

For data storage the file naming scheme was explained in Reference [4].

The raw data file names according to the inlet air angle are given in Table B.1.

B. PROBE CALIBRATION DATA

The lower traverse probe was recalibrated during a AE-4431 class lab period. The probe calibration constants were stored on Master Library cassette tape.

File names "P847" and "X847" were used to store pitch angle calibration and nondimensional velocity (x) calibration constants on the cassette tape.

TABLE B1 RAW DATA STORAGE

B_1	Raw BTOB Data	Raw Spanwise Data	Raw Instrumented Blade data
24.49	BW3312	SWU312 SWL312	IW312
24.80	BW3311	SWU311 SWL311	IW3311
28.12	BW3296	SWU296 SWL296	IW3296
28.00	BW3297	SWU297 SWL297	IW3297
32.87	BW3292	SWU292 SWL292	IW3292
32.95	BW3293	SWU293 SWL293	IW3293
37.10	BW3320	SWU320 SWL320	IW3320
36.91	BW3321	SWU321 SWL321	IW3321
38.89	BW3318	SWU318 SWL318	IW3318
38.91	BW3319	SWU319 SWL319	IW3319
42.92	BW3324	SW3324	IW3324
42.90	BW3325	SW3325	IW3325
45.90	BW3322	SW3322	IW3322
45.96	BW3323	SW3323	IW3323

APPENDIX C

NOTATIONS

ADVR	Axial Velocity--Density Ratio
C_{fB}	Coefficient of force based on surface pressure integration
C_{fM}	Coefficient of force based on momentum conservation
$C_{p_{static}}$	Coefficient of static pressure rise
C_{xB}	Coefficient of force in the x direction based on blade surface pressure integration
C_{yB}	Coefficient of force in the y direction based on blade surface pressure integration
C_{xM}	Coefficient of force in the x direction based on momentum conservation
C_{yM}	Coefficient of force in the y direction based on momentum conservation
c	Blade chord (inches)
D	Diffusion factor
h_i	Spanwise depth of control volume at inlet (i = 1) or outlet (i = 2)
i	Incidence angle (degrees)
k_1	$[\int_0^s \rho_1 V_1 \cos\beta_1 dx]/[\int_0^s \rho_{ref} V_{ref} \cos\beta_1 dx]$
k_2	$[\int_0^s \rho_2 V_2 \cos\beta_2 dx]/[\int_0^s \rho_{ref} V_{ref} \cos\beta_2 dx]$
P	Pressure (in H_2O)
Q	Dynamic Pressure (in H_2O)
s	Blade-to-blade spacing (inches)
T	Temperature (°R)

V	Velocity (ft/sec)
W	Relative velocity (ft/sec)
X	Velocity, non-dimensionalized by the "limiting" velocity, $V_T = \sqrt{2 C_p T_t}$
x	Coordinate in the axial direction (inches)
z	Coordinate in the spanwise direction (inches)
β	Air angle, measured in the blade-to-blade plane (degrees)
γ	Stagger angle (degrees)
δ	Deviation angle (degrees)
σ	Solidity (c/s)
Φ	Pitch angle (of air flow), measured in the spanwise, blade-to-blade plane
ϕ	Blade camber angle (degrees)
Ω	$[\bar{\omega}\cos^3\beta_2/2\sigma\cos^2\beta_1]$ Loss coefficient parameter
$\bar{\omega}$	Loss coefficient

Subscripts

i	Refers to traversing plane; i = 1 for inlet, i = 2 for outlet
p	Pressure
plen	Plenum (supply)
s	Static
t	Total
u	In the blade-to-blade (x) direction
$w\ell$	North wall, lower plane
1	Inlet plane
2	Outlet plane

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